NATIONAL EXOTIC WOODBORER/BARK BEETLE SURVEY PLAN 2003/2004

June 4, 2003

CONTENTS

NATIONAL EXOTIC WOODBORER/BARK BEETLE SURVEY 2003/2004

A NATIONAL PROGRAM OF INSPECTIONS AND SURVEYS FOR ASIAN LONGHORNED BEETLE, EMERALD ASH BORER, AND OTHER EXOTIC WOODBORERS AND BARK BEETLES

INTRODUCTION

Increasing international air traffic, tourism, commerce, and shipment of containerized cargo have provided new pathways of entry for non-indigenous or "exotic" insects. Movement of plant material is a major concern, as it allows new pests to enter the country, and the high volume of traffic in nursery stock and house and landscape plants can result in the movement of established immigrant insects throughout the United States.

Many exotic insects, such as woodboring longhorned beetles and bark beetles, pose a serious threat to the health of native North American forests, as well as to planted trees and pulpwood. Containers make cargo less accessible to port inspectors and allow movement of cargo into the continental interior. If exotic forest pest insects become established, they have the potential to kill trees and modify or disrupt our native forest ecosystems. Changes in the sources of non-indigenous pests track with the changing and expanding patterns of trade.

The potential impact of exotic woodborers and bark beetles in U.S. ecosystems is far-reaching. This document provides a basic guide and resource for conducting educational programs, inspections, and surveys at high-risk sites to determine if infestations of exotic woodborers and bark beetles exist in the United States.

The Animal and Plant Health Inspection Service (APHIS) continues to expand its survey activities to detect non-indigenous woodborer and bark beetle species. In addition to its inspection and trapping activities in and around warehouses located near major air and sea ports of entry and dunnage storage and disposal areas, survey efforts last year included inspection of nursery and dealer facilities receiving shipments of bonsai or other live woody plants. Visual surveys in warehouses yielded the greatest results, with eight species of exotic woodborer or bark beetles discovered on Asian origin shipments. The public outreach program is reportedly creating awareness of these beetle pests by providing information to and encouraging contact from warehouse personnel and other members of the public who observe suspicious beetles.

APHIS recognizes that a major entry pathway for these bark and woodborer beetles is in or on dunnage or solid wood packing materials (SWPM) such as boxes, crating and pallets, and wooden

cable spools, as non-indigenous beetles commonly infest these items. SWPM and dunnage are usually low quality wood, often with bark attached. Adult beetles and immature forms secrete themselves in obscure areas of these items. In the 1990s, the Asian longhorned beetle (ALB) *Anoplophora glabripennis* (Motschulsky), a large exotic woodborer beetle, may have entered the U.S. in SWPM that accompanied cargo from China. Soon after its discovery in New York City and Long Island, an outbreak of the pest occurred in Chicago. ALB is native to Asia, occurring in China, Japan, and Korea. ALB feeds on a wide variety of tree species (See Attachment 5). Left unchecked, populations of this invasive species could have serious impacts on forestry and environmental resources in the United States.

In 2002, the emerald ash borer (EAB), *Agrilus planipennis* (Fairmaire), was discovered in Michigan and, in 2003, in Ohio. Also a native of China, Japan, Korea and Mongolia, EAB shares the woodboring habit of ALB, and probably entered the United States by a similar route, in dunnage or SWPM. When EAB was discovered, it had already established a stronghold in the Detroit area in the ash tree hosts. A period of two or more years may pass before infested ash trees demonstrate the first signs of decline indicative of the activities of this insect, and Michigan officials estimate EAB may have been introduced as many as eight years before it was detected. Such lag time between entry and detection can allow certain exotic pests adequate time to establish dense, potentially destructive, populations that can spread to other areas of the U.S.

To prevent further introductions, the Solid Wood Packing Material Interim Rule (SWPM IR) regulates the entry and handling of packing materials from China. This Interim Rule became effective for shipments leaving China on December 17, 1998 and is predicated on the discovery of the Asian longhorned beetle in the United States from China in SWPM. Since the enactment of the Rule, APHIS has increased port inspections of cargo that may contain SWPM from China and requires fumigation of Chinese-origin SWPM.

Both the United States and Canada intercept quarantine insects that threaten our forest ecosystems on many different commodities from a variety of originating countries. The data from the U.S. and Canada indicate that interceptions have been made in wood items accompanying a diverse array of commodities, including: wooden and wire cable spools (China), wooden crating with granite blocks (India, China), wooden packing boxes bearing metal valves (Italy), and wooden pallets carrying ceramic tiles (Brazil). Due to the Interim Regulation, inspection of Chinese SWPM and dunnage must still be considered a priority. Although surveillance of SWPM and dunnage may continue to emphasize Asian origin materials, other countries of origin should not be overlooked. Based on the historical interception data, additional specific commodity groups, such as bonsai and live woody plants, should also be targeted for follow up inspection and survey actions.

INTERAGENCY COORDINATION

The Forest Service (FS) and APHIS are both interested in continuing to protect the health and integrity of our forests and rangeland resources. Furthermore, both agencies recognize that the early detection of and response to exotic forest pests is the most effective method for preventing their establishment and spread. In 2001, the FS and APHIS signed a Memorandum of Understanding (MOU) that provides direction to the two agencies to respond to nonnative invasive forest insects, diseases and weeds and identifies agency invasive species responsibilities and areas of coordination.

In 2001, the FS and APHIS also signed a Charter for an Exotic Pest Rapid Detection Team (RapDet) composed of representatives from FS, APHIS, National Plant Board, National Association of State Foresters, and *ad hoc* members who were added to the team as appropriate. Team objectives were to develop and test a prototype national survey; identify potential exotic pests and likely introduction pathways; identify detection and management guidelines; detect and monitor new introductions at selected high-risk sites; develop recommendations to address gaps in detection protocols and taxonomic resources; and use the information collected to set agency protocols and priorities, using the data entered into NAPIS. Field units composed of FS, APHIS and State field specialists used these protocols to detect and monitor newly introduced exotic insect pests, pathogens, and plants at selected high-risk sites.

The initial focus of RapDet was to detect nonnative bark beetles. The team expanded to include experts in detection of exotic bark beetles from the Oregon Department of Agriculture, Maryland Department of Agriculture, Cornell University, and the Agricultural Research Service. The expanded RapDet team developed common protocols for detection surveys, identification, reporting results and notification of detections. The following ten non-native bark and ambrosia beetle species were targeted because they were the Scolytidae most commonly intercepted during APHIS port inspections: *Hylurgops palliatus*, *Hylurgus ligniperda*, *Ips erosus*, Ips *sexdentatus*, *Ips typographus*, *Pityogenes chalcographus*, *Tomicus minor*, *Tomicus piniperda*, *Trypodendron domesticus* and *Xyleborus spp.* In 2001 and 2002, the FS, APHIS and state representatives placed baited funnel traps in forests around port facilities, wood handling facilities and urban forests in three to four cities in each of the Northeastern, Southern and Western areas of the United States.

The joint effort has produced new information about the exotic Scolytidae in the United States. In 2001, *H. palliatus*, a targeted species, was trapped near Erie, PA, and new state and county records for other nonnative species were established in the South, Northeast and West. In 2002, the pilot projects detected for the first time in North America two nonnative Scolytidae, *Xyleborus similis* in Houston, TX, and *Xyleborus glabratus* in Port Wentworth, GA. In addition, *Hylurgops palliatus* was detected at multiple sites in Pennsylvania, and state and county distribution records were expanded in all three participating regions. In 2003, the team will conduct detection surveys near Lafayette LA, Columbia SC, Raleigh NC, Asheville NC, Denver CO, Ogden, UT, Fairbanks, AK and Spokane,

WA. A delimitation survey for *H. palliatus* (and possible detection survey for the nun moth, *Lymantria monacha*), will be conducted in PA, NY and OH. A delimitation survey for *Xylosandrus multilatus* will be performed across eight states in the southeast. This interagency survey demonstrates the feasibility of a regionally coordinated national survey for detection of exotic Scolytidae. Attachment 13 lists major contacts for the pilot.

TARGET SPECIES

Species selected by the Cooperative Agricultural Pest Survey (CAPS) committee as targets for the National Exotic Woodborer/Bark Beetle Survey are listed on the table, below.

NOTE: Survey personnel are encouraged to record and report detections of forest pests, including non-coleopterous pests, made while conducting the prescribed woodborer/ bark beetle survey.

Scientific Name	Common Name (s)
Agrilus planipennis (Fairmaire)	**Emerald ash borer (EAB)**
Anoplophora chinensis (Forster) (= *Anoplophora malasiaca* Thompson)	**Rough shouldered longhorned beetle, Citrus longhorned beetle (CLB)**
Anoplophora glabripennis (Motchulsky)	**Asian longhorned beetle (ALB)**
Callidiellum rufipenne (Motchulsky)	**Lesser Japanese cedar longhorned beetle**
Chlorophorous annularis (Fabricius)	**Bamboo longhorned beetle/tiger bamboo longhorned beetle**
Hesperophanes (Trichoferus) campestris (Faldermann)	**Chinese longhorned beetle**
Hylurgops (Hylurgus) palliatus (Gyllenhal)	**No common English name; (German common name, "Bastkaefer")**
Hylurgus ligniperda (Fabricius)	**Red-haired bark beetle, golden-haired beetle**
Ips sexdentatus (Boerner)	**Six-toothed bark beetle**
Ips typographus (Linneaus)	**European spruce bark beetle**
Monochamus alternatus (Hope)	**Japanese pine sawyer**
Pityogenes chalcographus (Linnaeus)	**Spruce engraver**
Tetropium castaneum (Linnaeus)	**No common English name**
Tetropium fuscum (Fabricius)	**Brown spruce longhorned beetle**
Tomicus minor (Hartig)	**Lesser pine shoot beetle**
Tomicus piniperda (Linnaeus)	**Pine shoot beetle, Japanese pine engraver (PSB)**
Trypodendron domesticus (Linnaeus)	**No common English name, (German common name, "Borkenkaefer")**
Xyloborus spp.	
Xylotrechus spp.	

SURVEY GUIDELINES, NATIONAL AND LOCAL COORDINATION

The survey guidelines contained in this document are, of necessity, general and provide basic standardized procedures for conducting woodborer and bark beetle surveys throughout the U.S. The various elements of the survey were selected by consensus of the National CAPS committee, which coordinates this national survey. In practice, surveys are coordinated through the PPQ Plant Health Director's office of each state. The goals of the survey from a national perspective are to obtain information about:

- The presence, distribution, or absence of the target species,

- The advent of new exotic species,
- Patterns of infestation throughout the U.S. and possible pathways for introduction,
- The phenology of target exotic species in the U.S. and their selection of hosts,
- The characteristics of high risk habitats or sites,
- The presence of other potential forest pests in survey areas,
- The survey methods, themselves, and how they may be used in developing methods for control.

Timely reporting of survey results and the identification of any new species detected in the course of the survey is essential. New pest detections should be entered in the National Agricultural Pest Information System (NAPIS) database within forty-eight hours of confirmed identification, and survey results should be entered into the NAPIS database on a continuous basis (but in any case, not more than six months after the annual survey has ended). This practice enhances the value of the NAPIS database to users and planners, whose fundamental interest is in continuing the health and integrity of our native forests.

SELECTING HIGH RISK SITES

In different areas of the U.S., the selection of high-risk sites may vary. State Plant Health Directors, with their state cooperators, should address local circumstances and concerns to design the most effective use of resources and circumstances within their states, bearing in mind that the national focus of this survey requires a degree of uniformity in types of sites sampled, methods of data collection and reporting. Those requirements being met and given priority, collecting additional information is compatible with the national goals of the survey.

APHIS has identified SWPM as a high-risk pathway for introduction of woodborer and bark beetles. Because this material has been coming into the country for a long time, PPQ has created databases with information on the port interceptions of actionable pests associated with SWPM. This data was collected from the Emergency Action Notifications (PPQ Form 523) issued in the recent past. The database allows us to report the intended destinations of the cargoes that were found to be infested or otherwise subject to pertinent regulation.

In previous years (beginning in 2001), most of the establishments listed in the database were contacted, visited, and/or inspected/surveyed for ALB. Some of these establishments were trapped for other exotic woodborers and bark beetles. In the process, many additional establishments were discovered that handled imported cargo with potentially high risk SWPM. In FY 2004, the emphasis on surveying for ALB will be shared with searching for EAB, and survey and trapping for other exotic woodborers and bark beetles will be significantly increased. Deepwater ports in the Great Lakes area have shown that this is a major entryway for woodborer pests, and survey efforts will be intensified in these ports.

The discovery of an established population of EAB makes it clear, however, that spread of this beetle through human activities such as movement of nursery stock, firewood, and other wood material necessitates vigilance for exotic beetles throughout the interior of the country. For the current survey, we are placing some importance on enlisting interested volunteers throughout the U.S. These persons will be aware of the signs of potential infestations and can provide the fine-grained, yet widespread coverage needed to detect an incipient infestation.

Sites should be selected using the following criteria:

- Establishments and environs around sites where exotic woodborers/bark beetles were discovered during previous surveys or inspections.
- Nurseries and dealers receiving shipments of foreign bonsai or other living woody plants.
- Nurseries that have received ash trees from areas near Detroit and around the Great Lakes.
- Establishments in the Emergency Action Notification (PPQ 523) database as having received cargo treated for pests or bark at ports of entry from January 1, 2001 to December 31, 2001. (See Attachment 9 for 2001)
- Establishments and environs around sites handling high risk cargo and SWPM not in the database but identified from contacts and leads during previous surveys (Attachments 8 and 9).
- Environs around sites where dunnage is removed from ships and stored and disposed of, especially along the Mississippi and its tributaries and along the Great Lakes.
- Urban forests, urban parks and arboretums.
- Environs around sites where large amounts of urban tree and branch debris are collected, stored, and eventually disposed of (e.g. green waste recyclers, landfills, firewood dealers and repositories, sawmills, and incinerators) (Attachment 10 lists only New York handlers, because this area handles waste in a particular manner that causes concern for the spread of ALB).

Figure 1. Trident maple bonsai with exit hole. Photo: L. Cruse PPQ.

- Warehouses and surrounding environs located near major seaports or airports of entry where the risk of pest introduction is high because of the proximity of dunnage, wooden cable spools, wooden crating, and arrivals of bulk cargo of steel, stone, heavy machinery, and other wood packed items.

- Native production and non-production forested areas outside the immediate port environs, within *X* mile radius that is determined at the outset of the survey by availability of personnel and resources.

CONDUCTING INSPECTIONS AND SURVEYS

Required activities include:

- Contacting and visiting establishments,
- Distributing educational material,
- Inspection of SWPM or the imported bonsai or woody plants in the establishment (if appropriate);

- Survey of the environment around the establishment; and follow-up with survey around areas where the importer may have redistributed SWPM (e.g. landfills, pallet remanufacturers, reshipment in the original packing materials) firewood dealers, sawmills, utility companies, or establishments dealing in bonsai or live woody plants.

Establishment Contact, Communication, and Inspection

During initial visits to establishments, the inspector will provide educational materials to personnel and ask for their ongoing cooperation. Educational materials should consist, at minimum, of descriptions of potential pests (with illustrations or photographs) and the damage they cause, possible hosts or places the pests are likely to be, and the importance of reporting any detections. Each state will provide a telephone number or other easy communication mechanism that will allow and encourage the public to notify the appropriate persons of any detections they might make.

Initial contact with the establishments should determine the history of the establishment, and its handling of cargo, especially cargo accompanied by Asian-origin SWPM and bonsai or woody plants (see Attachment 2 for interview questions). The information collected during the initial contact will determine what survey activities (if any) are appropriate considering the material imported by the establishment (tree survey form is Attachment 3).

Visual inspections should be made of Asian-origin SWPM, foreign bonsai or woody plant material that is currently being stored or grown at the establishment for any signs of woodborer activity. Any suspect insects are forwarded for identification to determine the need for any action.

Survey Activities and General Guidelines

Based on the information collected in the establishment interview or on the occurrence of any detections of target species, visual surveys are conducted during any feasible time of the year. Guidelines for surveys follow.

A. For Asian longhorned beetle (ALB):

Figure 2. Asian longhorned beetle with exit holes. Photo: Ken Law,

At the importing establishment:

Conduct ground based visual surveys of 50 to 100 potential host trees surrounding the site for ALB. Managers may choose to use bucket trucks and tree climbers based on the availability of resources. Only include trees that are within 1.25 miles of the site. Concentrate on preferred hardwood hosts, e.g. maple, horse chestnut, poplar, elm, willow. (See Attachment 3 – Tree Survey Recording Form. A host list is contained in Attachment 5.)

Figure 3. Asian Longhorned beetle with galleries. Photo: Charles Harrington, USDA

- Look for typical ALB damage (see Pest Alert No. NA-PR-01-99) or active adults on standing, live or dying (but not dead) trees. Surveyors should use binoculars at the very least. If available, "bucket trucks", "cherry pickers" and other mechanisms for putting surveyors into the upper parts of trees increase the chances of detecting an infestation. Contracting with tree care businesses to do this work may be considered.

- Obtain wood samples from suspect, damaged trees to extract larvae or other ALB life stages.

- Submit larval or adult insect specimens for identification to the appropriate PPQ Area Identifier or State diagnostic lab depending on local arrangements.

- Submit any suspect insect survey samples identified by the state or PPQ taxonomists as ALB (or any other suspect exotic pest) to the ARS Systematic Entomology Laboratory (SEL) for final determination.

Additional sites

The importing establishment may have disposed of SWPM at a landfill, shipped it to a recycling company, or shipped it to other consignees resulting in the movement of imported commodity. Nurseries and individuals may have reshipped imported bonsai and other live woody material to other destinations. This information is gathered during the initial interview with the establishment personnel.

- If the Asian-origin SWPM was disposed of at a landfill, then visually survey 50-100 available host trees surrounding the landfill following the same guidance as addressed in visual survey at the importing establishment.

- If significant amounts of the Asian-origin SWPM was shipped to another consignee along with the commodity and it is practicable, then the second establishment should be contacted, essential information collected and surveys should be conducted as above.

- Where possible, information on the ultimate destination(s) of imported bonsai and other woody plants should be collected and those destinations contacted and possible follow up surveys planned. If the final destination is in another state, contact should be made with the SPHD in the destination state and the host material information provided for follow-up.

- Any recycling companies which receive host material should be visited and evaluated as possible survey sites.

B. For emerald ash borer (EAB)

At designated sites (i.e., sawmills, nurseries, firewood dealers):

- Conduct ground based visual surveys of 50 to 100 potential host trees (i.e., any species of ash) surrounding the site for EAB. Only include trees that are within 1.25 miles of the site. If symptoms of decline are noted in ash trees, closer visual inspection should be conducted. Symptoms of decline include: a) thinning foliage and crowns, b) callused sapwood tissue at sites of larval galleries, c) longitudinal bark splits (5-10 cm long), and d) epicormic branches (i.e., branches that grow

Figure 4. D-shaped exit hole in ash caused by emerged adult. Photo" Dave Roberts, Michigan

out of the main stem of a tree from buds produced under the bark), which turn brown prematurely. Look for D-shaped exit holes.

- Bark removal surveys can be conducted. By the third year after an infestation, the ash tree may have few viable branches, little foliage, and many bark splits and epicormic branches (esp. at lower trunk and ground line).

Figure 5. Ash tree showing epicormic branches. Photo: Dave Roberts, Michigan State Extension Service.

- Look for typical EAB damage (see Pest Alert No. NA-PR-07-02) or active adults on standing, live, dying or dead trees. Obtain wood samples from suspect, damaged trees to extract larvae or other EAB life stages.

- Last, D-shaped exit holes may be found on the lower trunk, especially in late stage infestations, but "bucket trucks", "cherry pickers" and other mechanisms for putting surveyors into the upper parts of trees may be used to confirm infestations in the upper trunk and limbs. Contracting with tree care businesses to do this work may be considered.

- Submit larval or adult insect specimens for identification to the appropriate PPQ Area Identifier or State diagnostic lab, depending on local arrangements.

- Submit any insect survey samples identified by the state or PPQ taxonomists as EAB (or any other suspect exotic pest) to the ARS Systematic Entomology Laboratory (SEL) for final determination.

Additional sites

The most important criteria for selecting a site are the presence of the ash host and reports of "decline" in its local populations. Regardless of location, these reports should be investigated, as this scenario is that which led to the initial discoveries of EAB in both Detroit and in Windsor, Ontario. In the case of EAB, it is not as important for persons to know each of the exact symptoms of an infestation as it is that they know to report trees that simply do not appear healthy. Volunteers, with some basic training in survey techniques and handling of any potential detections, can act as sentinels throughout the U.S. to report

Figure 6. Symptoms of ash decline include thinning foliage. Photo: Michigan Department of

observing ash decline symptoms and any other evidence of EAB in local forests or urban landscaped areas.

Importing establishments may have disposed of SWPM at landfills, shipped it to recycling companies, or shipped it to other consignees with subsequent movement of imported commodity. Nurseries and individuals may have reshipped imported bonsai and other live woody material to other destinations. Firewood may have been sold to individuals or wholesalers. This information is gathered during the initial interview with the establishment personnel. Because detecting the presence of this beetle is difficult, as best, in the early stages of infestation, the movement of logs, firewood and nursery stock within North America may represent the greatest danger of spreading this beetle to remote areas of the continental interior.

- If the SWPM was disposed of at a landfill, then visually survey a minimum of 50-100 host trees surrounding the landfill. Only include trees that are within 1.25 miles of the site.

- If significant amounts of the SWPM were shipped to another consignee along with the commodity and it is practicable, contact the second establishment, collect essential information and survey, as above.

- When possible, collect information on the ultimate destination(s) of imported bonsai and other woody plants and follow up by contacting those destinations for possible surveys. If the final destination is in another state, contact the SPHD in the destination state and provide information on the host or commodity being transported.

- Visit and evaluate any recycling companies that receive host material as possible survey sites.

Photos of Emerald Ash Borer and Tree Injury

Figure 7. Adult emerald ash borer. Photo: US Forest Service

Figure 8. Emerald ash borer larva. Photo: Michigan Department of Agriculture.

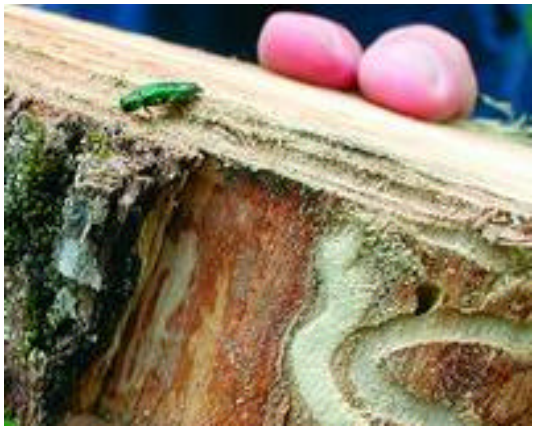


Figure 9. Newly-emerged emerald ash borer adult. Photo: US Forest Service

Figure 10. Emerald ash borer larval gallery. Photo: US Forest Service

C. For brown spruce longhorned beetle (BSLB)

At designated sites (i.e., sawmills, nurseries, firewood dealers):

- Conduct ground based visual surveys of a maximum sample of 50 to 100 potential host trees (i.e., any species of spruce, with special attention to red, black and Norway spruce, and to white pine in the vicinity) surrounding the site for BSLB. Only include trees that are within 1.25 miles of the site. If symptoms of infestation are noted, closer visual inspection should be conducted. ***Damage caused by BSLB may be similar to that caused by native species; therefore, it is essential to investigate more closely if suspected damage is observed.*** The primary symptom of an infestation is abnormally heavy sap flow, scattered streams of resin the length of the trunk from (usually) lower areas on the trunk. The needles turn progressively yellow to brown and are lost from portions of the crown. When the tree dies, the remaining foliage turns reddish brown. Exit holes are round to oval in the bark (approx. 4 mm diameter), and L-shaped feeding tunnels wind through the wood under the bark (up to 6 mm diameter).

Figure 11. Abnormally heavy resin flow may indicate the presence of the brown spruce longhorned beetle. Photo: Canadian Food Inspection Service.

- Bark removal surveys can be conducted to inspect for winding feeding galleries.
- Obtain wood samples from suspect, damaged trees to extract larvae or other BSLB life stages.
- Submit larval or adult insect specimens for identification to the appropriate PPQ Area Identifier or State diagnostic lab, depending on local arrangements.
- Submit any suspect insect survey samples identified by the state or PPQ taxonomists as BSLB (or any other suspect exotic pest) to the ARS Systematic Entomology Laboratory (SEL) for final determination.

Additional sites

Importing establishments may have disposed of SWPM at landfills, shipped it to recycling companies, or shipped it to other consignees with subsequent movement of imported commodity. Nurseries and individuals may have reshipped imported bonsai and other live woody material to other destinations. Firewood may have been sold to individuals or wholesalers. This information is gathered during the initial interview with the establishment personnel. Because detecting the presence of this beetle is difficult, as best, in the early stages of infestation, the movement of logs, firewood and nursery stock within North America may represent the greatest danger of spreading this beetle to remote areas of the continental interior.

Figure 12. Illustration of female brown spruce longhorned beetle from Canadian Food Service.

- If the SWPM was disposed of at a landfill, then visually survey 50-100 host trees surrounding the landfill. Only include trees that are within 1.25 miles of the site.

- If significant amounts of the SWPM were shipped to another consignee along with the commodity and it is practicable, contact the second establishment, collect essential information and survey, as above.

- When possible, collect information on the ultimate destination(s) of imported bonsai and other woody plants and follow up by contacting those destinations for possible surveys. If the final destination is in another state, contact the SPHD in the destination state and provide the host material information.

- Visit and evaluate any recycling companies that receive host material as possible survey sites.

D. For other wood borers/bark beetles, or other "exotic species"

Ideally, trapping should be conducted for as long as resources allow between March and October, depending on local climate.

At the importing establishment:

Two types of traps have been successful in attracting other woodborer pests. These are black light traps and Lindgren funnel traps. Descriptions of deployment of these survey tools are discussed in detail in the Attachments (11 and 12). A list of commercial suppliers of trapping equipment is attached

(Attachment 14). A literature review (Attachment 15) of bark beetles and trapping methods is included n this document for further information. Briefly, traps are deployed as follows:

- Place black light traps within the warehouse, greenhouse, or other storage facility. For larger facilities, use more than one light trap. Record results on a sheet similar to Attachment 4.

- Group three sets of three traps (i.e., each set consisting of three Lindgren funnel traps, each trap containing one of the three lures: Ultra High Release (UHR) alpha-pinene, UHR ethanol, 3-component exotic *Ips* EBB lures) outside the warehouse, greenhouse or other storage facility. *See Attachment 12 for detailed guidelines for trap placement and servicing.*

- Check and service traps biweekly for the length of the survey (i.e., March – October).

- Submit larval or adult insect specimens for identification to the appropriate PPQ Area Identifier or State Diagnostic Lab depending on local arrangements.

- Submit any insect survey samples identified by the State or PPQ taxonomists as a suspect exotic pest to the Agricultural Research Service Systematic Entomology Laboratory (ARS/SEL) for final determination.

Additional Sites:

Other than the initial importer, establishments such as recycling companies, disposal sites, bonsai dealers, container de-vanning areas, etc. should be visited and evaluated as possible survey sites. Survey tools for these sites are the same as for the importing establishments above.

RECORD KEEPING AND REPORTING OF SURVEY RESULTS

Reporting and information transfer is summarized in a checklist in Attachment 15. All survey data are reported through the NAPIS database. Ideally, these data should be entered continuously (e.g., daily, weekly, or bi-weekly). These data form the basis for future survey targets, and are reviewed by the CAPS committee for planning purposes. They are used by agencies and persons concerned with forest health and integrity throughout the U.S.. The accuracy and completeness of the data entered is of paramount importance.

When reporting survey results to these databases, please be aware that negative results (i.e., no detections of a pest) are as important as positive results.

The person designated by the SPHD should:

- Record results of surveys using the NAPIS Data Entry Sheets (instructions are on Attachment 1) and report these to NAPIS as obtained. It is important that data are entered into the NAPIS database without delay, ideally on a continuous basis. Annual negative summaries should be entered at the conclusion of the survey. Positive detections should be entered within 48 hours after the confirmed identification has been reported to the SPRO.

- Maintain records of interviews of establishments. Use the attached Interview Recording Form (Attachment 2) or any form that includes the same information requested on the Interview Recording Form.

- Record results on the Establishment Interview Reporting Form (Attachment 2) and report these to the SPHD.

PPQ survey personnel report all survey results to their SPHDs and enter data into the NAPIS database on a continuous basis. The report results are collated by region, then reported to the PPQ National Survey Coordinator, CAPS, and the Rapid Detection Coordinator for the US Forest Service.

TRAPPING AND IDENTIFICATION OF SPECIMENS

State Plant Health Directors are the central management persons for trapping programs. Beyond using the guidelines contained within this document as a basis for the survey to ensure uniformity of approach and data collection, the dedication of personnel and resources is determined by each SPHD. Current known lures are listed in the Pest risk assessments and on Attachment 6. When trapping in areas where cerambycid beetles are suspected, ultra high release alpha-pinene should always be used in conjunction with ultra high release ethanol. Trap cards (Attachment 4) should be maintained for each trap deployed.

Detailed instructions on the processing of trap specimens are provided in Attachments 11 and 12. **Field sorting of trap catches is *not* advisble.** Trap catches should be forwarded immediately to the local identifier (i.e., local cooperator, APHIS, FS offices or laboratories) for sorting. Any tentative identifications of significant detections must be submitted by the local identifier to a national expert for confirmation.

NOTIFICATION OF NEW DETECTIONS, COORDINATION WITH U.S. FOREST SERVICE AND STATE PLANT REGULATORY OFFICIALS

Timely information flow is essential when a significant detection is made of a new exotic woodborer or bark beetle, or of a target species in a new location (checklist summary of process in Attachment 15). Note that the groups in the data collection and database maintenance "sub-system," although not

directly involved in the detection notification process, should be kept informed, as they are an integral part of the surveillance and communications process.

Records of new detections should be entered in the NAPIS database within forty-eight hours after notification of SPRO that the identity of a specimen is confirmed.

The following reporting scheme should be followed to aid in the orderly flow of information:

1. Detection is made, either in field, or when trap contents are sorted by designated personnel.
2. Insect sample is submitted to the local identifier.
3. Local identifier submits suspect insect to USDA-recognized national expert (e.g., ARS, SEL) for confirmation.
4. National expert communicates positive identification to local identifier.
5. Local identifier then notifies:
    a. National Survey Coordinator
    b. PPQ SPHD in the state where the specimen was found
    c. SPRO in the state where the specimen was found
    d. PPQ Emergency Programs
    e. PPQ Taxonomic Group
    f. FS RapDet Coordinator
6. The PPQ SPHD notifies the Regional Office
7. Local identifier enters detection data in NAPIS database (within 48 hours after SPRO notified)

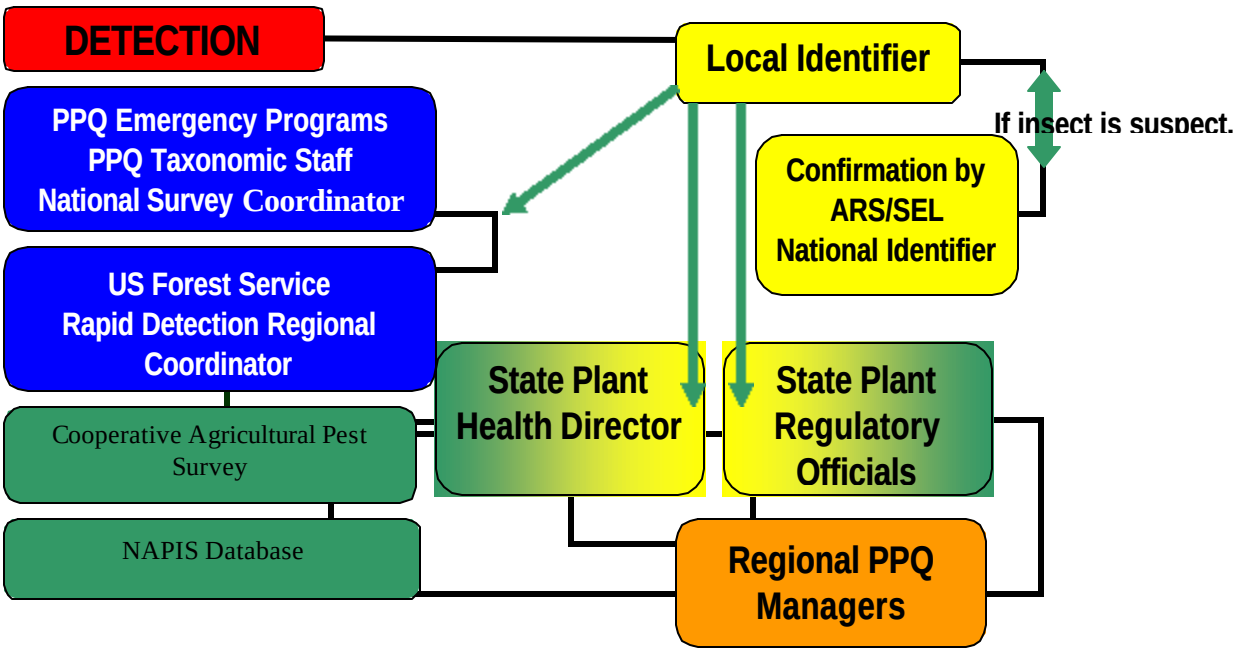


Figure 13. Schematic of Notification and Data Management Systems Involved in New Exotic Woodborer Bark Beetle Detection

The local identifier carries out notification of interested parties at both PPQ and FS (see Attachment 13) after the identification of the detected beetle is confirmed by a national identifier. The local identifier should notify both the PPQ SPHD and the SPRO of a detection, as well as the PPQ CAPS, Taxonomic Group, Emergency Programs and FS RapDet Coordinator. All efforts regarding control, suppression or eradication of the new detection are coordinated through the SPHD, who notifies his or her Regional Management persons.

OTHER EDUCATIONAL PROGRAMS

Educational programs enhance public vigilance for exotic insect pests and foster support and cooperation by the public. Public outreach programs should be implemented whenever possible, and the following guidelines may be useful for creating and maintaining a successful educational program:

- Collaborate with Cooperative Agricultural Pest Survey (CAPS), Extension Service and other outreach entities to make the public and industries aware that sightings of ALB, EAB, or any unusual insect or disease problems should be reported. Provide educational materials in languages other than English, if necessary.

- Discuss with tree care professionals and including nursery professionals the importance of their reporting of any unusual insect or disease problems, including ALB or EAB.

- In the event of a detection, coordinate efforts with local governments to insure that appropriate actions will be implemented.

- Provide all APHIS cooperators with worldwide web site addresses that contain appropriate information for downloading and sharing with the public, industries, and media.

USEFUL WEB SITES ON BARK BEETLES IN GENERAL

Web Site Title	Address
Animal and Plant Health Inspection (APHIS) Home Page	http://www.aphis.usda.gov

Bark Beetles of North America (Bugwood Network)	http://www.barkbeetles.org/
Canadian Food Inspection Service (CFIA) Home Page	http://www.inspection.gc.ca
Exotic Forest Pest Information System for North America	http://spfnic.fs.fed.us/exfor
Global Invasive Species Database	http://www.issg.org/database
Invasive Species Council	http://www.invasives.org/
National Agricultural Pest Information Service (NAPIS) public web site:	http://ceris.purdue.edu/napis
Plant Protection and Quarantine (PPQ) Home Page	http://www.aphis.usda.gov/ppq/ep/
University of Georgia Bugwood Page	http://www.bugwood.org/
USDA Forest Service Home Page	http://www.fs.fed.us/foresthealth
Field Guide to Forest Damage in British Columbia	http://www.for.gov.bc.ca/hfp/forsite/pest_field_guide/index.htm

Handouts for importing establishments:

Whenever possible, educational and informational handouts should be provided in the language that is most accessible to the target audience. Currently, APHIS/LPA has available Asian Longhorned beetle pamphlets in English and Spanish.

- Pamphlet/Handouts for Importers:
    1. Program Aid No. 1618, Identifying the Asian Longhorned Beetle pocket card
    2. Program Aid No. 1592, Be on the Alert for the Asian Longhorned Beetle
    3. Program Aid No. 1663, Have You Seen This Beetle? ALB poster
    4. Save Trees! ALB brochure
    5. PPQ Industry Report New Import Regulations for Packing Containers from China 4/1999.
    6. Others that may be updated or published periodically

- Wanted Poster for Asian Longhorned Beetle

Program Aids and the Wanted Poster can be ordered from APHIS/LPA in Riverside Maryland by faxing APHIS form 187-R to 301-734-5221 to the attention of Dan Parry.

PPQ fact sheets and industry reports are available from the APHIS home page under "Hot Issues, Publications, Asian Longhorned Beetle."

Survey aids:

- Host list (Attachment 5)
- What to look for: Pest Alert NA-PR-01-99
- Asian Longhorned Beetle or Whitespotted Sawyer? NA-PR-01-98

Multiple Reporting forms:

- NAPIS Data Entry Worksheets (Attachment 1)
- Two part Establishment Interview Recording Form (Attachment 2)
- Tree Survey Recording Form (Attachment 3)

ATTACHMENT 1

NAPIS Data Entry Worksheets:

Worksheets have been created specifically for the Exotic Wood Borer/Bark Beetle National Survey**.** The data entry worksheets for this survey are available at these web site addresses:

- NAPIS public site **http://www.ceris.purdue.edu/napis/**
- The ALB warehouse survey should be reported on the "Visual Observations" worksheet
- The ALB environs survey should be reported on the "ALB tree survey" worksheet.
- Trapping results should be reported on the "Trapping survey" worksheet.
- Examples of the worksheets are provided.

The trapping input form may be used with either the Lindgren funnel trap or the black light trap, but both types of trap cannot be entered on the same data sheet. The difference in trap type will be entered in the NOTES field (see attached data entry worksheet for details).

NAPIS DATA ENTRY WORKSHEET DATA DUE:

VISUAL OBSERVATIONS

NATIONAL Exotic Woodborer/Bark Beetle Survey

NEW STATE or COUNTY positives should be reported immediately.
Complete 1 record/year/data source/county/similar sites/pest species for negatives.

Observation Number	Observation Date (YEAR)(month)(day)	Data Source
,	,	,

(Assigned locally) Create your own record Identifier

Date when negative survey was completed in county. or For positive finds enter exact date [YYYYMMDD]

11=USDA-APHIS
13=STATE AG Dept
15=PRIVATE/COMMRCIAL
16=Joint Fed/State
41=General Public
see reference file

State-County	EPA Site Code	Crop Life Stage	Crop Situation
,	9 9 9 9 9 ,	,	,

State & county FIPS codes — Unknown — LEAVE BLANK

70000 = shipping point
77004 = commercial storage
77000 = industrial property
see reference file for more options

Location Coordinates		EPA Pest Code
LEAVE BLANK ,	LEAVE BLANK ,	,

Latitude Longitude

Pest Life Stage	Pest Status	Survey Method	Quantification
,	,	0 0 5 5 1 ,	,

I5 Adult - =no beetles
I6 larval +B =beetles found NOT established

National Exotic woodborer/bark beetle survey

# of beetles
# of larvae
0 if negative

VISUAL OBSERVATION

+B2=new state record (if first positive for state)
+B3=new cnty record (if first positive in a county other than the new state record)

Descriptor Units	Total Units Checked	Positive Units	Observation Duration	Diagnostic Lab
3 1 2 ,	,	,	,	,

312 Pests in/on trees

Total number of properties properties

Number of positive beginning & in which beetles were found

Number of days between file for code end of survey

Refer to lab reference

Confirmation Method	Biocontrol Target
,	LEAVE BLANK ,

90011 - visual ID positive no microscope
90010 - visual negative survey

Notes

Comments in English or prearranged code about optional information
Field now can contain up to 40 characters(i.e. indicated type of site as in landfill, pallet remanufacturers, importing establishment, etc.)

NAPIS DATA ENTRY WORKSHEET — DATA DUE: December 01

ASIAN LONGHORNED BEETLE TREE SURVEY

National Exotic Woodborer/Bark Beetle Survey

(NEW STATE or COUNTY positives should be reported IMMEDIATELY.)
(Complete 1 record /year /data source /county /type of property inspected and found negative.)

Observation Number	Observation Date (YEAR)(month)(day)	Data Source

(Assigned locally) — create your own record identifier

Date when negative survey was completed in county. For positive finds enter exact date. [YYYYMMDD]

11=USDA-APHIS
13=STATE AG Dept
15=PRIVATE/COMMERCL
16=Joint State/Fed
41=General Public
others=see reference file

State-County	EPA Site Code	Crop Life Stage	Crop Situation

State & county FIPS codes

Tree Species code LEAVE BLANK — CROP-REF file for POSITIVE or 99999-UNKNOWN for negative survey

70000 = shipping point
77004 = commercial storage
77000 = industrial property
see reference file for others

Location Coordinates		EPA Pest Code
LEAVE BLANK	LEAVE BLANK	I N A L Q C A
Latitude	Longitude	Asian Longhorned Beetle

Pest Life Stage	Pest Status	Survey Method	Quantification
I 5		0 0 5 5 1	

Adult - =no beetles
+B=beetles found
+B2=new state record

ALB Tree Survey
NATIONAL Exotic
Woodboring/Bark

positive trees
0 if all trees negative

+B3=new cnty record Beetle Survey

Descriptor Units	Total Units Checked	Positive Units	Observation Duration	Diagnostic Lab
,	,	,	,	,
318=infected plants (trees)	IF record is positive enter 1 otherwise # of negative properties	enter 1 if record is positive	Number of days between beginning & end of survey	Refer to lab reference file for code if positives were identified

Confirmation Method	Biocontrol Target
,	LEAVE BLANK ,

90011 - visual ID positive no microscope
90010 - visual survey, negative

Notes

Comments in English or prearranged code about optional information
Field now can contain up to 40 characters.
(i.e. indicate whether site is land fill, type of importing establishment, pallet remanufacturers, etc.)

NAPIS DATA ENTRY WORKSHEET — DATA DUE:

TRAPPING SURVEY — December 01

NATIONAL Exotic Woodborer/Bark Beetle Survey

(NEW STATE or COUNTY positives should be reported immediately.)
(Complete 1 record /year /data source /county /similar sites /pest species for negatives.)

Observation Number	Observation Date (YEAR)(month)(day)	Data Source

(Assigned locally) — create your own record identifier

Date when negative survey was completed in county. or For positive finds enter exact date. [YYYYMMDD]

11=USDA-APHIS
13=STATE AG Dept
15=PRIVATE/COMMERCL
16=JointState/Fed
41=General Public
see reference file

State-County	EPA Site Code	Crop Life Stage	Crop Situation
	9 9 9 9 9		

State & county FIPS codes — Unknown — LEAVE BLANK

70000 = shipping point
77004 = commercial storage
77000 = industrial property
see reference file for more options

Location Coordinates		EPA Pest Code
LEAVE BLANK	LEAVE BLANK	

Latitude — Longitude

```
|--------|-----------------|-----------------|--------------------|
|Pest    | Pest Status     | Survey          | Quantification     |
|Life    |                 |  Method         |                    |
|Stage   |                 |                 |                    |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| I  5 , |               , | 0  0  5  5  1 , |                  , |
|--------|-----------------|-----------------|-------- -----------|
I5 Adult   - =no beetles      National Exotic          # of beetles
          +B =beetles found   woodborer/bark
              NOT established    beetle survey         0 if negative

                               VISUAL OBSERVATION
       +B2=new state record (if first positive for state)
       +B3=new cnty record  (if first positive in a county other than
                             the new state record)
|-----------|--------------|--------------|-----------|-----------|
|Descriptor |Total Units   |Positive      |Observation|Diagnostic |
|Units      |Checked       |Units         |Duration   |Lab        |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| 3  3  0 , |            , |             ,|          ,|         , |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
Pest(s) in  Total number    Number of      Number of     Refer to lab
trap(s)     of traps of     positive       days traps    reference
            the same type   traps of the   in place
            at one site     same type

|-----------------|-----------------------|
|Confirmation     |Biocontrol             |
|Method           |Target                 |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
|               , | LEAVE BLANK         , |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
 90011 - visual ID positive  no microscope
 90010 - visual negative survey

|-----------------------------------------------------------|
|                          Notes                            |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
|                                                           |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
 Comments in English or prearranged code about optional information
 Field now can contain up to 40 characters

REQUIRED first 9 characters:
SMR00051;   if Lindgren Funnel traps used
SMR00013;   if Black Light traps used
```

ATTACHMENT 2

Asian Longhorned Beetle/Woodborer/Bark Beetle Multiple Purpose Reporting Form Establishment Interview Recording Form	
Inspector:	**Date:**
Establishment name:	**Contact person:**
Address :	**Phone number(s):**
Type of Business:	
Please include brief description of the types of items:	
Wood Products Tools/Machinery Raw Materials Construction Electronics Imports, Miscellaneous Consumer Goods Manufacturing Other	
Cargo Inspected (list):	**Country or Countries of Origin:**

Interview Questions		
Name of person interviewed:		
Title of person interviewed:		
How long have you been receiving these types of cargo?		
How long have you been at this location?		
Does your establishment currently have Asian-origin SWPM, foreign origin bonsai, or other woody plants?	**Y**	**N**
Have Asian-origin SWPM, foreign origin bonsai, or other woody plants been forwarded from your establishment to other establishments?	**Y**	**N**
If yes, please give name, address, and telephone of the establishment:		

What type of SWPM do you receive? Crates Pallets Spools Dunnage Spacers Stickers Skidders Chips/Shavings Other	Give brief statement of quality (e.g., rough sawn, with bark, green, clean dimensional, etc.)	

How is SWPM normally handled by your establishment? Please give any narrative concerning quantities of SWPM handled in this way, how often, or other details:

Stored

on site

off site

Location:

Shipped with cargo

Sold to reconditioning or recycling companies

Name:

Location:

Given away

as firewood

to employees

other

Taken to a landfill

Location:

Burned

on site

off site

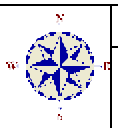
Location:

Other, describe

Have you noticed or found any insects or other pests on imported items?	**Y**	**N**
Have you noticed any dead or dying trees or shrubs on your property or nearby?	**Y**	**N**

Do you know of any other businesses that regularly import products from overseas? Details, including name and location, if available:	**Y**	**N**
IF INSPECTION OR PEST SURVEY IS CONDUCTED, PLEASE COMPLETE FOLLOWING SECTION:		
Asian Longhorned Beetle/Woodborer/Bark Beetle Premises/Solid Wood Packing and Other Material Inspection Recording Form		
If inspection was conducted, what materials on site were inspected? Please provide any details of condition of wood, note of any signs of insect damage. Crates Pallets Spools Dunnage Spacers Stickers Skidders Chips/Shavings Other		
Were specimens found?	**Y**	**N**
Were specimens forwarded?	**Y**	**N**
If yes, to whom:		
On what date?		
Are windows or any other light sources that may attract insects present?	**Y**	**N**
Are host trees, or potential host trees, on or near the property:	**Y**	**N**
If yes, complete table, below:		

Host Tree/Shrub Potential Host	Size of Host	Approximate Number	Distance	Signs of Insect Damage

Observed Possible ALB Damage	**Y**	**N**
Asian Longhorned Beetle Tree Survey Recording Form		
Inspector:	**Date:**	
Was survey conducted?	**Y**	**N**
If yes, what species of trees were examined? List species.	How many of each?	
Was survey conducted from the ground, bucket trucks, or tree climbers?	**Y**	**N**
Was evidence of an infestation found?	**Y**	**N**
If yes, diagram site, give details of location and evidence:		
	Details	
Were specimens forwarded?	**Y**	**N**
If yes, to whom? Name:	On what date?	
Address:		

ATTACHMENT 4

NATIONAL EXOTIC WOOD BORER AND BARK BEETLE SURVEY TRAP CARD

Port:	SITE DIAGRAM 
Site:	
GPS (if available):	
Address:	
Trap Type	
Black Light (B)	
Lindgren #___ Funnel Trap (L#__)	
Lure	
UHR ethanol (E)	
alpha-pinene (A)	
Triple Lure (3)	
Other (specify)	

Date	Initials	Trap	E	A	3	Other

Port

SWPM/Dunnage

Landfill

Urban Forest

Other

When completed, this card should be forwarded to the SPHD and to the local US Forest Service RapDet coordinator.

ATTACHMENT 5

Annotated Categorization of ALB Hosts

Revised October 29, 2001, Alan Sawyer, USDA-APHIS-PPQ, Otis Plant Protection Laboratory

Category1	Genus2	Common Name	Host Abundance and Other Notes3	Listed for Treatment
Very good host	*Acer*	Maple, boxelder	Very common	yes
"	*Aesculus*	Horse chestnut, buckeye	Uncommon	yes
"	*Salix*	Willow	Common	yes
Good host	*Betula*	Birch	Uncommon	yes
"	*Populus*	Poplar (apparently excluding cottonwood)	Common; Good host in China but few records in US. Oviposition: 2 records, NY	yes
"	*Ulmus*	Elm	Very common	yes
Occasional or rare host in US	*Albizia*	Mimosa, silk tree	Uncommon; Exit: 2 records, NY; 4 larvae reared to adult from wood collected in NY; no Chinese record	yes
"	*Celtis*	Hackberry	Common; Oviposition: 1 record, IL, with large larva positively identified as ALB; no Chinese record	yes
"	*Fraxinus*	Ash (especially green ash, F. pennsylvanica)	Very common; Injury attributed to ALB (exit holes: 44 records from IL, oviposition: 21 records from IL, 1 from NY) has been uncommon in relation to host abundance; host in Chinese literature	yes
"	*Platanus*	Plane tree, sycamore	Common; Exit: 3 records, NY; large larva reared to adult on diet; host in Chinese literature	yes
"	*Sorbus*	Mountain-ash	Uncommon; Exit: 1 record, IL; no Chinese record	yes

[1] Host suitability based on records of relative infestation rates, rearing results, laboratory studies and Chinese literature.

[2] Host genera listed alphabetically within categories

[3] Host abundance based on program records and on Nowack, D. J., 1994, "Urban Forest Structure: The State of Chicago's Urban Forest," pp. 3-18 *In:* E. G. McPherson et al., **Chicago's Urban Forest Ecosystem: Results of the Chicago Urban Forest Climate Project**. Gen. Tech. Rep. NE-186, USDA Forest Service, Northeast Forest Experiment Sta., Radnor, PA

ATTACHMENT 6

Pests, Lures and Trapping Methods

USDA FS Rapid Detection of Exotic Scolytidae Pilot Project

Target pest	Port interceptions (Number, ports)	Lure / source	Trap design /source
***Scolytid* species**	156	Alpha pinene, ethanol, Ips lure	Lindgren funnel trap/ Pherotech
Ips erosus	63	Alpha pinene, ethanol, Ips lure	Lindgren funnel trap/ Pherotech
Pityogenes chalcographus	55	Alpha pinene, ethanol, Ips lure Chalcoprax lure	Lindgren funnel trap/ Pherotech
Hylurgops palliatus	42	Alpha pinene, ethanol, Ips lure	Lindgren funnel trap/ Pherotech
Ips typographus	38	Alpha pinene, Ips lure	Lindgren funnel trap/ Pherotech
Hylurgus ligniperda	31	Alpha pinene, Ips lure	Lindgren funnel trap/ Pherotech
Tomicus piniperda	17	Double alpha pinene, Ips lure	Lindgren funnel trap/ Pherotech
Ips sexdentatus	15	Alpha pinene, Ips lure	Lindgren funnel trap/ Pherotech
Trypodendron domesticus	2	Special lure, Alpha-pinene lure	Lindgren funnel trap/ Pherotech
Tomicus minor	*6*	3 component lure, Alpha pinene lure	Lindgren funnel trap/ Pherotech

Other Trap and Lure Combinations from Oregon State Department of Agriculture

Target Pest	Lure	Trap Design
Cerambycidae	alpha-pinene AND UHR ethanol	Lindgren funnel trap/ Pherotech
Tetropium fuscum	spruce blend/ ethanol	Lindgren funnel trap/ Pherotech
Tetropium castaneum	spruce blend/ethanol	Lindgren funnel trap/ Pherotech
Xylosandrus spp.	4-5 UHR ethanol	Lindgren funnel trap/ Pherotech

Pest Risk Assessments

Agrilus planipennis (Fairmaire)	**Emerald ash borer (EAB)**
Anoplophora chinensis (Forster)= *(Anoplophora malasiaca* Thompson)	**Rough shouldered; citrus longhorned beetle (CLB)**
Anoplophora glabripennis (Motchulsky)	**Asian longhorned beetle (ALB)**
Callidiellum rufipenne (Motchulsky)	**Lesser Japanese cedar longhorned beetle**
Chlorophorous annularis (Fabricius)	**Bamboo /tiger bamboo longhorned beetle**
Hesperophanes (Trichoferus) campestris (Faldermann)	**Chinese longhorned beetle**
Hylurgops (Hylurgus) palliatus (Gyllenhal)	**No common English name**
Hylurgus ligniperda (Fabricius)	**Red-haired pine bark beetle**
Ips sexdentatus (Boerner)	**Six-toothed bark beetle**
Ips typographus (Linneaus)	**European spruce bark beetle**
Monochamus alternatus (Hope)	**Japanese pine sawyer**
Pityogenes chalcographus (Linnaeus)	**Spruce engraver**
Tetropium castaneum (Linnaeus)	**No common English name**
Tetropium fuscum (Fabricius)	**Brown spruce longhorned beetle (BSLB)**
Tomicus minor (Hartig)	**Lesser pine shoot beetle**
Tomicus piniperda (Linnaeus)	**Pine shoot beetle, Japanese pine engraver**
Trypodendron domesticus (Linnaeus)	**No common English name**
Xyloborus spp.	
Xylotrechus spp.	

Note: Data for some species are incomplete or absent. These data will be added in the future as they become available.

Agrilus planipennis (Fairmaire), emerald ash borer

Risk Factor	Rating	Narrative
Ecological Suitability	Moderate to High	Native to East Asia, including China, Japan, Manchuria, Korea, Mongolia, the Russian Far East, and Taiwan, its limiting distribution factor is minimum temperature threshold (i.e., -20^{0}F in Helongjiang Province, China). *A. planipennis* could establish in 2-4 or more U.S. hardiness zones.
Host Specificity	Low	Recorded in its native range from various *Fraxinus* species, especially *Fraxinus chinensis* and *F. rhynchophylla*, *A. planipennis* may also use the Ulmaceae and Juglandaceae, so the low host specificity rating should be considered conservative.
Survey Methodology	Unknown	Visual surveys may be conducted on trees exhibiting symptoms of decline (see Survey Protocols for emerald ash borer). Log bait traps have been used effectively to contain and monitor adult European populations.
Taxonomic Recognition	High	Larvae of the genus *Agrilus* are recognized among the buprestids by their tapering shape, and the urogomphi (pincer-like appendages) on the last abdominal segment. *A. planipennis* is the only agrilid that uses the ash host in North America, so *Agrilus* larvae found in ash trees can be identified as *A. planipennis*.
Destination of Imported Material	Low to High	Live specimens of *Agrilus sp*. have been intercepted from SWPM at U.S. and Canadian ports of entry. Artificial spread through human activities is high; natural spread, even in the presence of abundant ash host, is low (3 miles per year or less). Ash nursery stock and firewood are the most likely vectors for artificial spread.
Potential Economic Impact	High	Ash is valued as an urban landscape tree, a solid wood commodity, a component of timberland diversity, and as food, cover and habitat for wildlife. Larvae of *A. planipennis* destroy living host trees, both healthy and stressed, regardless of the age of the tree. Losses are projected at $20 to $60 billion, based on estimated populations of standing host trees in urban areas in the lower 48 states.

Entry Potential	Moderate to High	Live specimens of *Agrilus sp*. have been intercepted from SWPM at U.S. ports of entry. Debarking may help reduce the survival potential of the larvae, however, preliminary research suggests that debarking is insufficient to kill this insect.
Establishment Potential	High	*Agrilus planipennis* is competent in establishing a U.S. population, as it has probably been established in Michigan for at least five years.

Life Cycle	A typical life cycle for this pest is: Egg-->Larva-->Pupa-->Adult **Egg State:** Oval, cream-colored eggs turn brownish-yellow before hatching, are 1 x 0.6 mm, and deposited singly on bark or in crevices on the trunk or branches. **Larval Stage:** Mature larvae are 26-32 mm long, milky white, flattened dorso-ventrally, and tapering. The head is brown and mostly retracted into the prothorax, the mouthparts externally visible. The mesothorax bears one pair of spiracles, as do each of the abdominal segments 1-8. The terminal abdominal segment, 10, bears a brown urogomphi. Presumably *A. planipennis* larvae develop through four instars. **Pupal Stage:** The milky white pupae are 10-14 mm long. Antennae reach the base of the elytral buds. The last few segments of the abdomen bend slightly ventrad. **Adult Stage:** Adults are 7.5-15.0 mm long and 3.1-3.4 mm wide. The typical buprestid body is metallic golden green. Elytra are emerald green and punctate, with a ridged margin and rounded posterior tips bearing a serrated edge. The top of the abdomen, beneath the wings, is copper-red. The head is flat with dark copper, kidney-shaped, compound eyes. The antennae are short and serrate. Emerald ash borer appears to have a one year life cycle in southern Michigan, over wintering as a mature larva in its shallow sapwood chamber. Pupation begins in April/May and adults emerge from mid-May to late June through a 3-4 mm D-shaped, exit hole. On average, males live 13 days; females, 21.6 days. Females can mate several times producing a lifetime average of 76.6 eggs. Oviposition begins 7-9 days after mating, and eggs hatch 7-9 days later. Larvae chew through bark into the cambium and continue to feed on outer sapwood and phloem for several weeks. As they develop, larvae excavate 20-30 cm (range, 10-50 cm) long S-shaped galleries.
Websites of Interest:	http://www.msue.msu.edu/reg_se/roberts/ash/index.html http://www.inspection.gc.ca/english/ppc/science/pps/datasheets/agrplaer.shtml http://www.na.fs.fed.us/spfo/eab/index.html

Anoplophora chinensis (Forster) (=*malasiaca* [Thomson]), citrus longhorned beetle

Submitted by Dave Lance

Background: Several beetles of this species recently escaped from a bonsai nursery in Tukwila, Washington (Seattle area). It has also been intercepted on a number of other occasions, including warehouse finds in Georgia and Wisconsin. Its potential as a pest is at least as great as that of the closely related *A. glabripennis*.

Risk Factor	Rating	Narrative
Ecological Suitability	High	This species exists from southern China through Japan and Korea. It appears better adapted to tropical and subtropical areas than is *A. glabripennis*, but survives readily in Korea in areas where sub-freezing temperatures are common in winter. Its ability to survive in the colder portions of the U.S. is not specifically known.
Host Specificity	High	This insect is polyphagous. Based on Asian literature and interception data, host trees include the following families: *Aceraceae, Anacardiaceae, Araliaceae, Betulaceae, Eleagnaceae, Fagaceae, Lauraceae, Oleaceae, Polygonaceae, Styracaceae, Rutaceae, Rosaceae, Salicaceae, Ulmaceae, Moraceae, Meliaceae, Leguminosae, Juglandaceae, Aquifoliaceae, Platanaceae, Euphorbiaceae, Casuarinaceae, Verbenaceae, Sapindaceae, Theaceae*, and *Taxodiaceae*. Many of those families include commercially important genera as *Citrus, Acer, Alnus, Populus, Salix, Prunus*, and *Quercus*, among others.

Survey Methodology	Medium	No attractants are known, so surveys require visual identification of the insect, its damage, or by-products (e.g., frass). Use survey guidelines described for *A. glabripennis*, except that surveys for *A. chinensis* should focus on areas where recently imported bonsai and/or penjing materials are held. This should include nurseries, warehouses, or other areas with numbers of plants that could support emergence of multiple beetles within a short time (facilitating mating). If reproducing populations exist, exit holes in surrounding trees will likely be the most obvious sign. Quantities of frass also tend to accrue. This insect has a tendency to attack near the ground on many hosts, but this is apparently tree species-dependent (attacks some hosts high, much like *A. glabripennis* on larger hosts).
Taxonomic Recognition	High	A very distinctive insect that can be separated from the closely related *A. glabripennis* with (at most) a hand lens (the anterior portions of the elytra – or "shoulders" are rough; on *glabripennis*, they are smooth). Distinguishing larvae from other cerambycids requires a greater degree of expertise.
Destination of Imported Material	High	Bonsai and penjing trees are often held outdoors where beetles have an opportunity to emerge and escape. The Tukwila incident occurred in an outdoor post-entry quarantine, where high concentration of plants from a single shipment led to multiple insects emerging at about the same time and within a small area. This facilitated mating among the insects, several of which presumably emigrated from the nursery.
Potential Economic Impact	High	This species has potential comparable to that of *A. glabripennis* as a pest of forest and shade trees. In addition, it is a serious pest of citrus within its native range, and attacks a variety of other fruit trees as well. Unlike many cerambycids, it appears to be a primary pest of many of its hosts. Its ability to use North American tree species is largely untested, but if *A. glabripennis* is an indicator, it could well prove to be a more severe pest here than in its native range.
Entry Potential	High	Unlike *A. glabripennis*, which enters the U.S. primarily in solid wood packing materials, *A. chinensis* has been intercepted most often in living plant materials. Oviposition marks are difficult for inspectors to detect, especially on thin-barked trees, and are made more difficult to distinguish by the tendency of bonsai producers to intentionally scar tree trunks for decorative purposes.

Establishment Potential	High	Potential hosts are wide-spread and common, and it will survive climatic conditions within a large portion of the U.S. Interceptions are common.
Life Cycle		
Websites of Interest:	http://doacs.state.fl.us/~pi/enpp/ento/cbalert.htm This site has some nice close-up photos.	

Anoplophora glabripennis (Motschulsky), Asian longhorned beetle

Risk Factor	Rating	Narrative
Ecological Suitability	High	Native to northeastern, north central China and Korea; a major pest of poplar and willow throughout the latitudinal range of 21 degrees to 43 degrees north latitude in Asia
Host Specificity	High	Recorded in its native range from various hardwood tree species, including most importantly, *Acer, Populus, Salix, Ulmus, Morus, Melia* and *Robinia*; in N.A., known also from *Aesculus, Acer, Fraxinus, Populus*, and *Salix*.
Survey Methodology	Unknown	Attractant is not available at this time for this species. Visual surveys for adult and larval damage to hardwood trees are the only known method of detecting these longhorned beetles. There is a National Survey Protocol for this pest and special funding has been allocated in the past two years.
Taxonomic Recognition	High	Adult members of the genus *Anoplophora* are highly recognizable among the lamiine genera in North America. Species level identification is more difficult, but keys do exist for species-level identification.
Destination of Imported Material	High	Infested solid wood-packing material has already been found at numerous ports of entry and warehouse locations throughout North America.
Potential Economic Impact	High	*A. glabripennis* is recorded as a serious pest of ornamental poplar and maple in China. Larvae of this species are destructive to living and stressed host trees.
Entry Potential	Moderate/ High	
Establishment Potential	High	This is evidenced by its recent detection's in New York, NY, and in Chicago, IL.

Life Cycle	A typical life cycle for this pest is: Egg-->Larva-->Pupa-->Adult Egg State: The off-white oblong eggs are 5-7 mm in length. Both ends are slightly concave. Larval Stage: Mature larvae are 50 mm in length. The prothrax has a brown mark. The front of the mark does not have a brown margin. Pupal Stage: The off-white pupae are 30 - 33 mm in length with a width of 11 mm. The eighth segment of the abdomen has a protruding structure. Adult Stage: Adults are 20 - 35 mm in length and 7 - 12 mm in width. Their color is jet black with a luster. The antennae have 11 segments. The bases of the antennae are whitish with a blue-black. The antennae of the males are 2.5 times their body length; the antennae of the females are 1.3 times the body length. The base of the elytra does not have a granular structure. Each elytron has about 20 white dots. ALB can over winter as an egg, as a larva developed within an egg, as a larva, or as a pupa. The first three instars feed in the phoelm and the late third and early fourth instars move into the xylem. Adult emergence begins in May and peak populations occur in early July. Females live 14-66 days, males live 3-50 days. Females lay eggs and larvae thrive on healthy or stressed host trees of all ages and on recently cut logs. Adults tend to lay eggs on the same part of a tree, year after year, until that part dies.
Websites of Interest:	http://www.hcs.ohio-state.edu/ODNR/Health/alb.htm (This has an informative flash video link.) http://www.na.fs.fed.us/spfo/albpestalert/index.htm http://www.entomology.wisc.edu/mbcn/fea606.html http://spfnic.fs.fed.us/exfor

Callidiellum rufipenne (Motschultsky), Japanese cedar longhorned beetle

Risk Factor	Rating	Narrative
Ecological Suitability	High	This species is native to east Asia, occurring in China, Korea, Sakhalin Island, Japan, and the Ryukyu Islands.
Host Specificity	High	This species hosts include members of the coniferous families Cupressaceae and Taxodiaceae, many of which occur in North America.
Survey Methodology	High	Baited trap logs will attract adult beetles. The following inspection procedures have been suggested by USDA APHIS PPQ and the Connecticut Agricultural Experiment Station to aid growers and regulatory officials in locating occurrences of the Japanese cedar long horned beetle. 1. All stages of the beetle can be found in stems that are as small as inch in diameter to the large basal multi-trunks near the root ball. 2. Most often adult beetles are found at the base of the crotch where two branches join. 3. Look for any small puckering, inch or larger incision or where there is corkscrew or sinus mining, (often the bark has healed over these tunnels this time of year). Frass can often be seen in these openings. Take a sharp knife and gently scrape the upper bark to expose tunneling below the surface. The openings to these tunnels and/or pupal chambers often have a frass/sawdust plug. 4. Examine all sides of each branch, we had a few that showed damage on one side of the arborvitae. This damage could not be seen from the other side. 5. Listen for snapping of the branches as the arborvitae are spread open for examination. They are very brittle and the branches often break readily when there are multiple beetles in a stem. As many as 10 beetles have been found in one branch.

Taxonomic Recognition	High	In North America, there are only 2 native species of *Callidiellum*, both occurring on the West Coast. *Callidiellum rufipenne* is distinctive by its coloration and other morphological features.
Destination of Imported Material	High	This exotic species has been intercepted on numerous occasions at the port of Wilmington, North Carolina and elsewhere in the US
Potential Economic Impact	Moderate to High	This insect has the potential to become established in natural forests of Chamaecyparis, Juniperus and Thuja in North America. Several of these trees are commercially important and of high value. Because Cupressaceae are widely used as landscape plants, widespread infestations of this insect could cause severe damage to established landscapes in urban areas and limit the viability of these plants as ornamentals in the future.
Entry Potential	High	This exotic species has been recorded earlier in the century from Vancouver, British Columbia (1927) and Seattle, Washington (1954). It was found established in coastal North Carolina (Dare Co.) In 1977 and was found again in fall 1998 infesting arborvitae nursery stock in Connecticut.
Establishment Potential	High	As evidenced by early historical records of detections in the West and recent records from the Eastern US in 1997 (North Carolina) and 1998-99 (Southwestern Connecticut, New York, Long Island, and Staten Island).
Life Cycle	Apparently completing only one generation per year, *C. rufipenne* adults emerge in early spring, mate immediately, and the female begins laying her lifetime compliment of approximately 18 eggs (which are mature upon her emergence) over the subsequent two week period. Young larvae excavate shallow galleries under the bark in the cambium and phloem, later entering the xylem, where they construct pupal cells. They over winter as adults and bore 2 X 4 mm oval holes to exit.	

Websites of Interest:	http://www.fs.fed.us/foresthealth/i_d_news/issue5_091599.html http://www.aphis.usda.gov/npb/rufipenne.html http://www.aphis.usda.gov/npb/C.rupifenne%20alert.pdf http://www.eppo.org/QUARANTINE/Alert_List/Insects/clllru.html http://www.caes.state.ct.us/NewsReleases/newsbqa.htm http://www.agf.gov.bc.ca/cropprot/jlbeetle.htm http://www.inspection.gc.ca/english/ppc/science/pps/datasheets/calrufe.shtml (photos) http://spfnic.fs.fed.us/exfor

Chlorophorus annularis (Fabricius), Bamboo longhorn beetle/tiger bamboo longhorn beetle/tiger longicorn

Background: This species has been found on a number of occasions recently in bamboo poles and stakes at lumber from China. It is established in Hawaii.

Risk Factor	Rating	Narrative
Ecological Suitability	High	Exists in Asia from equatorial regions into temperate areas. Known to exist in China, India, Indonesia, Japan, Malaysia, Myanmar, Thailand and Vietnam.
Host Specificity	Moderate	This species primarily infests bamboo, and most reports are from dried bamboo. However, the insect has also been reported in sugarcane, citrus, pear, apple, teak, cotton, grape, corn, and, in the Chinese literature, maple. For many of these hosts, though, it's uncertain whether reports of associations are for larval damage or simply observations of flower-feeding by adults (which is common in this genus).
Survey Methodology	Mostly Unknown	Visual inspection of the exterior of bamboo poles for exit holes, which vary from circular to oval in shape and are from 2-3 mm in diameter
Taxonomic Recognition	High	The adults are fairly distinctive. The adult beetle is 9.5-17 mm long, 2.4-2.5 mm wide and ochre yellow in color, with dark brown or black curved markings on the elytra and pronotom.
Destination of Imported Material	High	Bamboo is distributed broadly for a wide variety of purposes, including staking of nursery stock.
Potential Economic Impact	Moderate	There is a great deal of uncertainty here depending on whether reported host associations were larval or simply adult feeing. It should be noted that some other members of the genus are agricultural pests.
Entry Potential	High	Entries into the U.S. and Europe appear to occur frequently in bamboo. Rapid dispersal is possible because of easy movement in exported bamboo. The larvae are frequently shipped to North America and Europe within air-dryed bamboo and products from bamboo. This will decline given a recent ruling that bamboo must now be treated.

Establishment Potential	Low to Moderate	The insect has apparently entered the continental U.S. on many occasions, but to the best of our knowledge, is not yet established.
Life Cycle	Normally, the beetle has one generation per year. However, larval development rate is affected by the dryness of the culm, and may continue even after the culm has been made into products. Adults occur from April to September and eggs are laid on cut ends or in cracks. Larvae over winter in tunnels in the culm. A typical life cycle for a beetle is the following: Egg→ Larva→Pupa→Adult **Egg Stage:** Eggs are laid on cut, air-dried bamboo. **Larval Stage:** The larvae burrow under the protection of the outer layer, essentially along the length. **Pupal Stage:** Pupation occurs near the surface. The exit holes are round-oval in shape. **Adult Stage:** The natural emergence of the young beetles occurs from May to September with the greatest emergence in June. The adult beetle is 10.0 to 15.0 mm in length and 2.2 to 4.0 mm in breath.	
Websites of Interest:	http://www.aphis.usda.gov/npb/bamboo.html http://www.aphis.usda.gov/npb/bamboo/CDFA%20advisory.pdf http://homepage2.nifty.com/otsuka/photo3/taketora.htm (photo) http://www.inbar.int/publication/txt/tr13/Longhorned%20Beetles136.htm#Tiger%20longicorn http://spfnic.fs.fed.us/exfor	

*Hesperophanes (Trichoferus) campestris (*Faldermann), Chinese longhorned beetle

Background: A small infestation of this pest was discovered in the yard of a warehouse in New Brunswick, NJ. Initially, a couple of beetles were found in traps (one baited with ethanol, a second with "triple lure"). The insects were then found infesting a dead elm near the site (the species has a high tolerance for dryness and often attacks dead wood, but will also take on live hosts, esp. in Rosaceae). The elm was removed and destroyed, and surveys are being carried out both by trapping and through visual inspection of trees in the surrounding areas. Climbers are being used to inspect larger trees.

Risk Factor	Rating	Narrative
Ecological Suitability	High	This longhorned beetle is recorded from Turkistan and adjacent regions, Amur, Northern Mongolia, Northern China, North Korea, and Japan
Host Specificity	High	This species is known to inhabit various broad-leaved trees, including a number of ornamental trees such as Willow, Elm, Poplar, Honey Locust, and Mulberry.
Survey Methodology	Unknown	Some literature suggest that black light trapping might attract adults.
Taxonomic Recognition	High	
Destination of Imported Material	High	Imported wood, infested by *H. campestris*, has already been discovered at various US Warehouse locations.
Potential Economic Impact	High	
Entry Potential	High	
Establishment Potential	High	
Life Cycle		
Websites of Interest:	http://ceris.purdue.edu/napis/pests/barkb/hespcfs.html http://spfnic.fs.fed.us/exfor	

Hylurgops (Hylurgus) palliatus (Gyllenhal)

Risk Factor	Rating	Narrative
Ecological Suitability		This insect is recorded from Russia, Italy, Latvia, Scandanavia and others.
Host Specificity		*Hylurgops palliatus* uses *Pinus spp*. and, possibly, other conifers.
Survey Methodology		
Taxonomic Recognition		
Destination of Imported Material		
Potential Economic Impact		
Entry Potential		Twenty-eight interceptions of this species were recorded in SWPM in US ports of entry from 1996-1998.
Establishment Potential		
Life Cycle		
Websites of Interest:	http://spfnic.fs.fed.us/exfor	

Hylurgus ligniperda (Fabricius), red-haired pine bark beetle, golden-haired bark beetle

Adapted from Andris Eglitis,with additions by Judith E. Pasek,
http://www.exoticforestpests.org/english/Detail.CFM?tblEntry__PestID=59

Risk Factor	Rating	Narrative
Ecological Suitability		*Hylurgus ligniperda* is native to Europe, including Great Britain, the Mediterranean Basin, the Caucasus Mountains and western Siberia. It has been introduced to South Africa, Japan, Sri Lanka, Australia, New Zealand, Brazil and Chile. Adults can over-winter.
Host Specificity	High	This beetle reportedly confines its feeding to *Pinus spp*. (pines) in its native range. In its introduced range, *H. ligniperda* has adapted to a broad range of pine trees, spruce, fir, and larch, and could probably adapt to a variety of novel hosts.
Survey Methodology		*Hylurgus ligniperda* is strongly attracted to freshly cut logs. Since the adult stage of the insect occurs throughout most of the year, attacks could occur on logs cut at virtually any time.
Taxonomic Recognition		Adults are golden-brown and heavily pubescent. Identification of bark beetles is best left to experts in the Scolytidae.
Destination of Imported Material		SWPM is distributed in and around ports, and is often disposed of in landfills. The numerous interceptions of *H. ligniperda* in SWPM at North American ports since the beginning of the bark-free requirement indicate that the host association is strong and that the SWPM pathway continues to be risky for bark-inhabiting scolytids.

Potential Economic Impact	Moderate	Pines are important commercial trees species in much of North America. The impacts of this pest are expected to be an increase in the prevalence of stain fungi in pine logs and increased seedling mortality due to adult maturation feeding. Stain reduces the value of lumber and can increase production costs of some wood products such as high quality paper. *Hylurgus ligniperda* is known to be a vector of several species of root disease causing fungi of the genus *Leptographium*. Should *H. ligniperda* become established in the West, it has the potential to become a vector of this black stain root disease caused by the fungus *Leptographium wagneri* and the fungus *L. procerum*, which causes procera root disease of white pines.
Entry Potential	High	From 1985-1994, 169 interceptions were made at US ports, primarily in European SWPM. After the SWPM IR came into effect in 1995, and until 1999, twenty interceptions were made. The introduction of *H. ligniperda* into many parts of the world and its continued interception in ports in association with solid wood packing material demonstrates its commitment to its host and survival capability in this substrate.
Establishment Potential	High	Adults can disperse over distances of several kilometers and an infestation can spread as long as host material is available. This strong capability of spread has been demonstrated in Australia where *H. ligniperda* spread up to 25 km from a fire-killed area within 18 months, and in Chile where the beetle now occupies the entire distribution of Monterey pine after being introduced into the country in the mid-1980's. *Hylurgus ligniperda* has demonstrated a competitive advantage over at least two similar species that were introduced into Chile in the 1980's. Although the initial distributions, habitats and abundance were similar, *H. ligniperda* eventually supplanted the other two species throughout the country. *Hylurgus ligniperda* appears to have established a population in and around (trapped approximately 15 miles west) of Rochester, NY. It is a strong disperser, and has demonstrated its ability to move up to 25 km in 18 days (in Australia), as long as host material is available.

Life Cycle	Female beetles initiate attacks on suitable host material by boring through the bark and constructing a small maturation chamber beneath the bark. Males join the females and mating takes place in these chambers. Females then construct a long winding oviposition gallery and lay eggs in notches cut in the sides of the gallery. One female may lay up to 500 eggs. Larvae feed beneath the bark and pupate once mature. Adults emerge and fly to new hosts at various times of the year, since these insects generally complete more than one generation per year. In France, there are two generations per year with first-generation adults laying eggs in the winter and spring, and the second generation laying eggs in the fall. In Chile, H. ligniperda completes three generations in a year and adults are present in virtually every month of the year. In South Africa, adults are also present throughout the year but are most active during periods of cool temperatures and high humidity, peaking in the fall (April - May) with minor peaks in the spring (September) and summer (January).
Websites of Interest:	http://spfnic.fs.fed.us/exfor

Ips sexadentatus (Boerner), six-toothed bark beetle

Adapted from William M. Ciesla, http://www.exoticforestpests.org/english/Detail.CFM?tblEntry__PestID=79

Risk Factor	Rating	Narrative
Ecological Suitability		Occurs in Asia from Turkey across Russia to China and south to Thailand and is widely distributed in China, Inner Mongolia. In Europe, it is widely distributed, from the British Isles, Spain and France east to Turkey and European Russia.
Host Specificity		*Pinus spp*. are the predominant hosts of this insect across its natural range, including: *P. sylvestris, P. nigra, P. pinaster, P. brutia* and *P. heldrichii* (=*P. leucodermis*). In Thailand, *P. merkusii* and *P. caribaea* (exotic) are hosts. Other conifer hosts in Europe and Asia include: *Abies alba, A. normanndiana, Larix decidua, L. sibirica, Picea abies , P. orientalis* and Douglas-fir, *Pseudotsuga menzeisii.*
Survey Methodology		Ips Lure is currently used to attract exotic Ipinae, and should be attractive to *Ips sexdentatus*.
Taxonomic Recognition		*Ips sexdentatus* is a large bark beetle, averaging 5.5-8.2 mm in length and dark brown in color. The adults are typical bark beetles of the subfamily Ipinae of the family Scolytidae. The head is covered by a thoracic shield and is not visible when viewed dorsally and the declivity is concave with each side is armed with a series of six conspicuous spines. Species identification of bark beetles (Family Scolytidae) must be done from the adult stage. Identification of insects suspected of being exotic species of *Ips* should be examined by a qualified insect taxonomist with expertise in the family Scolytidae.
Destination of Imported Material		Transport of unprocessed logs, wood products or wooden packing material, dunnage or pallets containing bark strips can provide a means of introduction of immature stages (larvae and pupae) and adults Adult beetles are capable of flying up to 4 km (ca 2.4 miles) in search of suitable host material.

Potential Economic Impact	Low	Assuming that this insect would behave in North America as it does in Eurasia, it would become one of the complex of engraver beetles already present in North America and would add little to the economic impact already incurred by indigenous species. *Ips sexdentatus* would not be expected to have a significant environmental impact, as it would become one of many organisms engaged in the deterioration of dead conifer wood.
Entry Potential		*Ips sexdentatus* was intercepted at US ports of entry on 136 occasions between 1985 and 1998, suggesting that this insect could easily be introduced into North America.
Establishment Potential	Moderate	Successful establishment is dependent on its ability to compete effectively with the large complex of *Ips* bark beetles indigenous to North America (approximately 30 species) including the North American six spined engraver beetle, *Ips calligraphus*, which is its North American ecological equivalent.

Life Cycle	*Ips sexdentatus* prefers to inhabit large trees with thick bark. This insect typically has two generations per year with adult flight periods from April to May and July to August. In Mediterranean regions of Europe, *I. sexdentatus* can undergo a third generation. Males construct nuptial chambers under the bark and are joined by 2-5 females. After mating, each female constructs a longitudinal egg gallery and deposits eggs in individual niches along each side of the gallery. The young larvae feed in galleries perpendicular to the egg galleries. Larval galleries increase as the larvae increase in size. Pupation takes place in round cambers constructed at the end of the larval galleries. Adults require maturation feeding before reaching sexual maturity. The first indication of infestation by *Ips sexdentatus* is that trees fade from green to yellow to reddish brown. While in the breeding season, infestations are characterized by the presence of reddish-brown boring dust on the bark surface of trees, freshly cut logs or wind throw. If relatively vigorous trees are infested, pitch tubes are found in bark crevasses. The gallery pattern in the cambial region of infested trees consists of a nuptial chamber and two to five longitudinal egg galleries ca 15 to 35 cm long. Breeding infestations are accompanied by blue stain in the woody tissue. Round exit holes, ca 4 mm in diameter can be seen on the bark surface of trees where this insect has completed its life cycle and adults have emerged.
Websites of Interest:	http://spfnic.fs.fed.us/exfor

Ips typographus (Linnaeus), European spruce bark beetle

Risk Factor	Rating	Narrative
Ecological Suitability	High	*Ips typographus*, the European spruce bark beetle, is widespread in Central and Western Europe, and is one of the most common and most harmful of the bark beetles.
Host Specificity	High	This exotic species chiefly attacks and kills coniferous trees (*Abies, Picea, Pinus,* and *Larix)*, already damaged by heavy winds, snow, and mechanical abrasion.
Survey Methodology	High	There are commercial pheromones (lures) available for this Palearctic bark beetle.

Taxonomic Recognition	High	Although there are several native species of *Ips* that occur in the Eastern US, that are superficially similar, *Ips typographus* is distinctive in several morphological features. Species identification of bark beetles (Family Scolytidae) must be done from the adult stage. Identification of insects suspected of being exotic species of *Ips* should be examined by a qualified insect taxonomist with expertise in the family Scolytidae.
Destination of Imported Material	High	Discarded infested dunnage has been found at various ports of entry in the US, and Canada since the early 1990s. Any SWPM made of spruce and containing bark can harbor life stages of the bark beetle. Solid wood packing material made from the other less common hosts would have a lower likelihood of association: moderate for pine and low for larch. If host material of any species is completely free of bark, the potential for the pest to be with the host at origin would be low. The numerous interceptions of *I. typographus* in SWPM at North American ports since 1995 (the beginning of the bark-free requirement) indicate that the host association is strong and that the SWPM pathway continues to be a risky one for bark-inhabiting scolytids.
Potential Economic Impact	High	*Ips typographus* favors cut or down material such as logs, trees damaged by storms, and other damaged tree material that contains viable cambium, and are usually found in old-growth forests.
Entry Potential	High	This species already has been intercepted at least 4 times in the 1990s**:** Once each Erie, PA; Camden, NJ, Indiana Dunes, IN, and Montreal, Quebec. Interceptions at ports of entry on the East and West Coasts have been numerous.
Establishment Potential	High	*Ips typographus* is robust in its ability to disperse, and to adapt to locally-available hosts and climactic conditions.
Life Cycle	Temperature dictates how many generations *I. typographus* may produce in one season. In southern areas, the beetle may have two peak emergence times, early spring and mid to late summer.	

Websites of Interest:	http://www.inspection.gc.ca/english/ppc/science/pps/datasheets/ipstype.shtml http://www.wcrl.ars.usda.gov/cec/insects/ipst.htm http://www.barkbeetles.org/exotic/htypgrph.html http://vinsonlab.tamu.edu/former/john/papers/plume1.htm http://spfnic.fs.fed.us/exfor

Monochamus alternatus (Hope), Japanese pine sawyer

Risk Factor	Rating	Narrative
Ecological Suitability	High	Several species of *Monochamus* occur in the United States. *Monochamus alternatus,* the Japanese pine sawyer, is widespread in Asia, occurring in China, Japan, Taiwan, Laos, and Korea.
Host Specificity	High	In Japan this species shows a preference for Japanese Red Pine (*Pinus densiflora)* and Japanese Black Pine (*Pinus thunbergii),* however it can also attack many other *Pinus* species. This exotic species has been known as one of the most destructive pests associated with dead pines in Japan. In addition to *Pinus spp.*, *M. alternatus* is known to infest *Larix spp.*, *Abies spp.*, *Picea spp.*, *Juniperus spp.*, *Quercus spp.*, *Pyrus spp.*, among others in it native range. The beetle vectors the phoretic pine wood nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle, which causes the serious pine wilt disease.
Survey Methodology	High	Commercial lures are available for the Japanese pine sawyer.
Taxonomic Recognition	High	This species is very distinguishable. It is quite different from any other North American native *Monochamus* species.
Destination of Imported Material	High	Infested wood crating, with associated live adults, was found in a plumbing warehouse in Western New York in June 1998. This exotic species is frequently intercepted at US Ports of entry.
Potential Economic Impact	High	Many species in this genus cause feeding damage and transmit harmful pathogenic organisms to living coniferous trees. *Monochamus alternatus* is the vector for the pine wood nematode, which causes the condition known as pine wilt, a serious and devastating disease in Asian pine forests. This condition can and has destroyed large tracts of Asian pines over the years. *Pinus thunbergii,* has been one of the most widely planted trees in seashore landscapes on Long Island because of its capacity to withstand salt spray and its usefulness as a windbreak and/or screen.
Entry Potential	High	

Establishment Potential	High	Several native species of *Monochamus* occur in the United States.
Life Cycle	A typical life cycle for this pest is: Egg→Larva→Pupa→Adult **Adult.** Length: 15-28 mm, width: 4.5-9.5 mm. Orange to brown, antenna dark brown. The base part of the 1st, 2nd and 3rd segment of male antenna has grayish hairs. Male antenna is about 2 times of body length, while female antenna is about one third longer than its body. There are two longitudinal orange stripes on the protergum. The two orange stripes are interlaced with three narrower black strips. Each elytra has 5 longitudinal bands consists of black and gray rectangular spots. **Egg**. 4 mm long, milk-white, sickle shaped **Larva.** Opaque, Narrow cylindrical. Mature larva can reach 43 mm. Head, dark brown. Protergum is brown with wavy strips. Larvae have 5 instars and progress, as they mature, from feeding on cambium to tunneling into heartwood (5-30 cm U-shaped tunnels). **Pupa**. Opaque, cylindrical. 20-26 mm long. The beetle completes one generation per year. Larvae overwinter within a U-shaped tunnel in heartwood they have excavated by feeding. Pupation takes place in late March. Females live for approximately 35-66 days, while males live for 42-98 days. Adults begin to emerge in mid-April in the evening and night, but may stay within host tree for 6-8 days. Exit holes are approximately 8-10 mm. Peak adult activity occurs in May, and adults can disperse to distances of 2.4 km. Ten days after emerging, the female begins to lay her eggs, and she may produce between 100-200 eggs in her lifetime. Oviposition behavior is similar to the Asian longhorned beetle's. Mating and egg-laying occurs in the evening. Female beetles prefer weak and freshly cut trees as oviposition sites, and oviposition is dependent of temperature (68^0F) and adequate photoperiod. Adult beetles of either sex may vector nematodes, which dwell within the spiracles of the adults. When the adult beetle makes contact with a nematode-infested tree, these parasites enter the beetle's body via the spiracles, and exit when a suitable host is later located by the beetle. Nematodes gain entry into the host tree through feeding wounds inflicted by *M. altenatus*. One adult beetle may contain up to 289000 nematodes.	
Websites of Interest:	http://www-unix.oit.umass.edu/~baodew/monochamusA.htm http://spfnic.fs.fed.us/exfor	

Pityogenes chalcographus (Linnaeus), spruce engraver

Risk Factor	Rating	Narrative
Ecological Suitability		Found throughout Europe.
Host Specificity		*Pityogenes chalcographus* ranks among the two most important killers of *Picea abies* (Norway spruce) in Europe. The beetles often cause severe damage to young, Christmas-tree sized stands of spruce. It is more rarely found on *Pinus* spp., *Larix* spp. or *Pseudotsuga douglasii*.
Survey Methodology		The beetles are attracted to pheromone from feeding males, which consists of two chemicals, chalcogran and methyl decadienoate. Chalcogran was discovered in 1977 and was shown to attract some beetles but not as well as a spruce log infested with beetles. In 1988, methyl decadienoate was discovered which together with chalcogran could attract about 35 times more beetles than chalcogran alone. Methyl decadienoate released alone did not attract any beetles at all.
Taxonomic Recognition		This beetle is small for bark beetles, being only 2 mm long and weighing only 1.2 mg. Species identification of bark beetles (Family Scolytidae) must be done from the adult stage. Identification of insects suspected of being *P. chalcograhus* should be examined by a qualified insect taxonomist with expertise in the family Scolytidae.
Destination of Imported Material		*Pityogenes chalcographus* breed in dead wood in forests, and may then attack nearby living trees. One potential source of such bark beetle attack is fuel wood stacked to dry in the forest.
Potential Economic Impact		*Pityogenes chalcographus* is associated with blue stain fungus.
Entry Potential		Thirty-eight interceptions of this insect were made at US ports in SWPM from 1996-1998.
Establishment Potential		

Life Cycle	An attracted male secures an area for his and several other females' young, while the females search for a male-dug nuptial chamber beneath the bark where she can begin a tunnel in which to lay eggs along the sides. The tunnels are excavated only in the thin phloem layer just under the bark. The phloem layer is only about 2-4 mm thick in Norway spruce and is rich in sugars and nutrients since this is the layer that transports sugars and amino acids, made by photosynthesis, from the needles to the roots. In all species of *Pityogenes* there are several females that join the single male in his nuptial chamber. Sometimes there can be as many as 10 females. Later arriving females seek males with fewer females. Since there is a 1 to 1 sex ratio of larvae and emerging adults, this means that many males never have young during their lifetime. The beetle also introduces blue stain fungi that inhibits the tree's ability to produce resin. Resin or sap flow is used by the tree to repel the beetles when they are trying to bore into the tree.
Websites of Interest:	http://spfnic.fs.fed.us/exfor

Tetropium castaneum (Linnaeus)

Background: This species was recently taken in traps in Oregon. *Tetropium castaneum* is the most frequently intercepted member of the genus and can readily occur in solid wood packing materials. With the recent establishment of a cogener (*T. fuscum*) in Halifax, NS, quarantine and potential pest status of this species has been reconsidered.

Risk Factor	Rating	Narrative
Ecological Suitability	Moderate to High	This species exists from Europe through Japan, and from Siberia to south to the Hunan province in China.
Host Specificity	Moderate to High	This species has been reported in pine, spruce, fir, larch oak and walnut. It is considered a secondary pest (i.e., attacks weakened or recently killed trees, including a number of conifers) in Europe and Asia, but *T. fuscum* was also not considered to be a threat to apparently healthy trees. The potential of this species to attack and damage living trees in the U.S. is largely unknown.
Survey Methodology	Moderate	*Tetropium castaneum* were captured in Lindgren funnel traps baited with ultra high release ethanol, spruce blend lure and alpha-pinene in Oregon.
Taxonomic Recognition	Moderate	
Destination of Imported Material	High	
Potential Economic Impact	Uncertain	Moderate to high, with a high degree of uncertainty.
Entry Potential	High	It is a broadly distributed and fairly common species that infests wood used for SWPM.
Establishment Potential	Moderate to High	The species may require the presence of weakened or recently dead conifers.
Life Cycle		

Websites of Interest:	http://www.uochb.cas.cz/~natur/cerambyx/tetcas.htm http://spfnic.fs.fed.us/exfor

Tetropium fuscum (Fabricius), Brown spruce longhorn beetle

Background: This species was not listed as a pest of quarantine significance for many years because it was thought incapable of damaging healthy trees. However, a recently established infestation in Halifax, NS, has been attacking and killing apparently red spruce (*Picea rubens*) and other species in Point Pleasant Park.

Risk Factor	Rating	Narrative
Ecological Suitability	Moderate to High	In Europe, the species exists from Lapland south to Italy and Turkey.
Host Specificity	Moderate	This species is reportedly a secondary pest (i.e., attacks weakened or recently killed trees, esp. Norway spruce) in Europe, but has readily attacked apparently healthy red spruce in Nova Scotia. Suitability of other New World spruce species is unknown, but both the closely related white & black spruce (and hybrids of those species with red) and/or western species may be at risk. Red spruce often live on sites with relatively poor, shallow soil; as a result, other conifers in the same areas may be stressed and susceptible to attack, especially if numbers of the beetles build up in the red spruce.
Survey Methodology	Moderate	Infested trees show characteristic "weeping" (sap flow) that can be readily seen from the ground, although use of this character for survey may lead to numerous "false positives" as it can be confused with sap flow from many other types of damage. Canadian officials had little luck this summer trying to capture the insects with trap/lure combinations that are typically used in attempts to capture cerambycids. A spruce blend/ethanol lure has been used successfully in Oregon. They are also trying spruce logs as baits, but data from those tests are not yet available.

Taxonomic Recognition	Moderate	Although apparently good characters exist for distinguishing adults, the pest went undetected for up to 10 years in Halifax because it was assumed to be a native species, *Tetropium cinnamopterum*. Larvae are difficult to distinguish from other *Tetropium*, esp. *T. gabrieli*. This suggests that a trained coleopterist should be consulted for final identification.
Destination of Imported Material	High	
Potential Economic Impact	High	Spruce, including red spruce, is an important lumber and pulpwood in the northeastern U.S. Potential effects on western forest industries would be difficult to predict at this point.
Entry Potential	Unknown, presumed High	Because of the non-pest status given to this insect for many years, U.S. interception data are not available on this pest. The infestation in Halifax and limited data from other countries (e.g., New Zealand) suggest that interceptions would not be rare events.
Establishment Potential	Ambiguous	Probably medium overall, but high in areas near red spruce or weakened conifers. Again, susceptibility of western spruce species and "street" Norway spruce in the U.S. (unknowns at this point) would affect this rating.
Life Cycle	*Tetropium fuscum* probably produces one generation per year. The female beetle lays her average 80 eggs singly or in small clusters on bark of standing or recently felled trees. Within two weeks, larvae begin excavating the cambium, producing a network of irregular tunnels, and attain a mature length of 1.5 to 2.5 cm within two months. Older larvae bore into phloem and produce an L-shaped tunnel in which pupation takes place. Adults emerge in about 14 days, boring a round or oval exit hole in the bark about 4-6mm in diameter, to commence their approximate three weeks of life in June to August. Both sexes are strong flyers. Young larvae over winter in the wood at a depth of up to 4 cm.	
Websites of Interest:	http://www.inspection.gc.ca/english/ppc/science/pps/datasheets/tetfuse.shtml http://ceris.purdue.edu/napis/pests/splhb/ http://www.pestalert.org/Detail.CFM?recordID=11 http://www.uochb.cas.cz/~natur/cerambyx/tefus.htm http://spfnic.fs.fed.us/exfor	

Tomicus minor (Hartig), lesser pine shoot beetle

Adapted from Jonathan Gary Lundgren,
http://www.exoticforestpests.org/english/Detail.CFM?tblEntry__PestID=115

Risk Factor	Rating	Narrative
Ecological Suitability		*Tomicus minor* is widely distributed in Europe (i.e., Spain, France, England, Finland, Sweden, Greece, and Scotland) and Asia (i.e., southeastern China, Siberia and Japan). *Tomicus minor* over-winters as an adult from November to January, usually when temperatures begin to drop below 12 degrees C, and so may spend up to 9 months inside of the shoots of pine trees maturation feeding and over-wintering. In areas where winter temperatures do not drop below 8 degrees C, *Tomicus* is able to conduct maturation feeding throughout the winter, and some beetles begin to oviposit as early as November and December.
Host Specificity		*Tomicus minor* confines its host range to *Pinus spp*. However, as it is a fungus feeder, it may be more adaptable to a broader array of new host species than the congener *T. piniperda* (see below). In addition, the pines that *T. minor* targets are economically and environmentally important species.
Survey Methodology		Trap logs inoculated with blue stain fungus are attractive to *T. minor*. Also, *T. minor* uses an aggregation pheromone, a mixture of (S)- and (R)-trans-verbenol and 3-carene-10-ol, to attract conspecific beetles.
Taxonomic Recognition		Identification should be by a qualified insect taxonomist with expertise in the family Scolytidae.
Destination of Imported Material		*Tomicus minor* has been intercepted at ports in the United States in SWPM, and human-facilitated dispersal is likely to be important for this pest.

Potential Economic Impact		In Europe, *T. minor* is regarded as a major pest of pine plantations. Adults of this species feed on young pine shoots and can significantly reduce tree growth. When populations reach epidemic levels, *T. minor* may transfer from weakened or dead trees to healthy trees. *Tomicus minor* transmits the blue stain fungus, *Ophiostoma minus*, which lowers the value of timber. Bark beetles like *Tomicus* are believed to maintain forest health in regions where they are endemic, though introductions of scolytids into new regions where beetles and hosts have not co-evolved may result in detrimental environmental impact.
Entry Potential		Apparently, *T. minor* is intercepted at ports in the United States. However, this species is not believed to be established here.
Establishment Potential		*Tomicus minor* is a pest in its native range, however, since the closely related *T. piniperda* has successfully established in North America, it is considered a high risk species. This species is regularly intercepted at United States ports, and demonstrates considerable plasticity in its ability to survive in extreme environments.
Life Cycle	*Tomicus minor* begins to disperse in early spring. This species prefers to oviposit on dying or stressed pines, usually after other insects have colonized the pine. *Tomicus minor* shares the same trees with *T. piniperda*, which prefer larger trees, and because *T. minor* prefers to attack trees with thinner bark. *Tomicus piniperda* appears to control where *T. minor* will eventually attack the trunk on the host tree Before tunneling into the tree, beetles aggregate in the crown of the host tree. Aggregation pheromones are an integral factor to *T. minor* colonization of host trees. The male beetle joins the female after she has created a nuptial chamber in a pine tree, and mating takes place. The female then burrows out two oviposition galleries in opposite directions from one another. Eggs are laid along these galleries and hatch between March and May. Larvae feed in galleries that are perpendicular to these oviposition galleries for several weeks. Larval gallery length increases as the number of eggs increases. *Tomicus minor* larvae are dependent on the blue stain fungus, *Ophiostoma minus*, which the mother transmits when she tunnels into the wood. Pupation occurs, and adults then emerge from holes in the bark in early to mid summer. From the natal tree, *T. minor* beetles disperse to feed in the shoots of susceptible pines. The adult beetle creates a tunnel inside the shoot that is characteristically 4-7 cm long.	

Websites of Interest:	http://spfnic.fs.fed.us/exfor

Tomicus piniperda (Linneaus), common pine shoot beetle, Japanese pine engraver

Adapted from William M. Ciesla, http://www.exoticforestpests.org/english/Detail.CFM?tblEntry__PestID=86

Risk Factor	Rating	Narrative
Ecological Suitability		*Tomicus piniperda* has a wide distribution across Europe, from the British Isles, France and Spain, to Asia, where it occurs across the entirety of Russia into eastern China. It is capable of over-wintering and is quick to colonize freshly cut pines. These beetles are associated with species of blue stain fungi. *Tomicus piniperda* completes one generation per year throughout its natural range in Asia and Europe.
Host Specificity		*Tomicus piniperda* uses *Pinus spp*. as primary host material, but has been found on other conifers, such as *Picea spp.* and *Pseudotsuga spp.*
Survey Methodology		Since *Tomicus piniperda* uses host volatiles, including alpha pinene to locate suitable breeding sites, this lure, already being used in the Lindgren© funnel traps, should be highly effective. Attraction to ethanol is weak.
Taxonomic Recognition		Identification should be by a qualified insect taxonomist with expertise in the family Scolytidae.
Destination of Imported Material		Quarantines, dictated by the phenology of local aggregates of the insect, have been imposed on US distributors of host material. Adult beetles are capable of flying ½mile (ca 1 km.) or more in search of suitable host material. Transport of wood products or wooden packing material, dunnage or pallets containing bark strips can provide a means for introduction of immature stages (larvae and pupae) and adults. Interception of *T. piniperda* at US ports of entry between 1985 and 1996 indicate that 70% occurred in dunnage, 29% in crating and 1% in pallets

Potential Economic Impact		Quarantines are already in effect in Michigan, Wisconsin, and Pennsylvania, affecting Christmas tree growers. Christmas tree production accounts for 900,000 acres in the US. Although the marketability of these trees may be adversely affected, the beetle does not usually kill trees, and, in fact, the impact the beetles would have outside the Christmas tree industry is low. Beetle feeding and their introduction of blue stain fungi contribute to decomposition of dead organic matter.
Entry Potential		This beetle is intercepted frequently at US ports of entry (120 times between 1985-1998), typically from France, the UK, Spain and Italy. Debarking, exposing to solar radiation, or treating logs with synthetic pyrethroids may prevent breeding in host material.
Establishment Potential		*Tomicus piniperda* has demonstrated ability to establish, having done so in Ohio (since 1992), and currently appearing in 243 counties in 9 states in the Great Lakes area and elsewhere.

Life Cycle	Over-wintering adults begin to fly on the first warm days of spring (50-54 degrees F). Adults quickly colonize recently cut stumps, logs or the trunks of severely weakened trees. Females initiate gallery construction and one male joins each female. After mating, females construct individual vertical egg galleries within the inner bark and outer sapwood, which extend 4 to 10 inches (10-25 cm) in length. The female lays eggs singly in niches that she cuts into both sides of the egg gallery. After hatching, larvae construct horizontal feeding galleries that are 1.5 to 3.5 inches (4-9 cm) in length. In the Great Lakes Region of the USA, most larvae complete development, pupate and transform into adults in May and June. The newly developed adults tunnel through the outer bark, creating exit holes about 2mm in diameter. They then fly to the crowns of live, healthy pines of all ages but tend to prefer the tallest trees. Adults feed in the upper half of the crown from May through October. Adults usually enter the shoots in one year old or current year's growth. They tunnel into the center of the shoot and bore outwards, hollowing out 1 to 4 inches of shoot. After several weeks, adults emerge and enter other shoots. Infested shoots generally bend near the point where the beetles entered, turn yellow to red, eventually break off and fall to the ground. Adult feeding is characterized by the presence of dead shoots with yellow to reddish-brown foliage on host trees. Examination of the shoots should reveal galleries and, possibly, adult beetles. Breeding attacks are characterized by reddish brown boring dust on the bark surface of trees and, if relatively vigorous trees are attacked, pitch tubes on the bark surface. The gallery pattern underneath the bark consists of a single, vertical egg gallery 4 to 10 inches (10-25 cm) long length and larval feeding galleries, perpendicular to the egg galleries that are 1.5 to 3.5 inches (4-9 cm) long. Breeding attacks are accompanied by blue stain in the xylem. Adults exit twigs soon after the first frosts and enter the thick bark at the base of pines to spend the winter.
Websites of Interest:	http://spfnic.fs.fed.us/exfor

Trypodendron domesticus (Linnaeus)

Risk Factor	Rating	Narrative
Ecological Suitability		Reported in Russia, Sweden, throughout Scandanavia.
Host Specificity		Reported on *Alnus incana* (alder). This tree species is found around the Great Lakes area and the northeastern US.
Survey Methodology		*Trypodendron domesticum* were attracted to window traps baited with ethanol and placed on Scots pine trees (*Pinus sylvestris*, May-June, 1986) in one Scandanavian study (Beyers, 1992, J. Chem. Ecol.).
Taxonomic Recognition		Species identification of bark beetles (Family Scolytidae) must be done from the adult stage. Identification should be by a qualified insect taxonomist with expertise in the family Scolytidae.
Destination of Imported Material		
Potential Economic Impact		
Entry Potential		
Establishment Potential		
Life Cycle		
Websites of Interest:	http://www.forestry.ubc.ca/fetch21/fetch21/tinybeetles.html video clip, "Life in a Log" featuring congener *Trypodendron lineatum* http://spfnic.fs.fed.us/exfor	

Xyloborus spp., ambrosia beetles

Risk Factor	Rating	Narrative
Ecological Suitability		
Host Specificity		
Survey Methodology		Ultra high release ethanol-baited Lindgren® Funnel Traps can be used to detect adults.
Taxonomic Recognition		
Destination of Imported Material		
Potential Economic Impact		Ambrosia beetles tunnel into heartwood causing brown strips of dead tissue in the cambium and discoloration in the heartwood.
Entry Potential		
Establishment Potential		
Life Cycle	Over-winter as adults in host. Adults appear in April and after mating, tunnel into a host to lay eggs. Larvae are present May-July. New adults remain in host to over--winter. One generation per year.	
Websites of Interest:	http://www.agf.gov.bc.ca/cropprot/fieldguide/ambrosia.htm http://spfnic.fs.fed.us/exfor	

Xylotrechus spp.

Background: A *Xylotrechus* beetle, identified as *X. hircus*, was recently taken in traps in Oregon. *Xylotrechus hircus* is native to eastern Russia and is not one of the more common members of the genus. It is ecologically associated with birch, and apparently has a restricted host range. *X. rusticus* (poplars, willows, boxelder, Europe and Asia), *X. altaicus* (larch, Siberia), and *X. namanganensis* (elm, China) are other *Xylotrechus* of concern that could be imported in SWPM. Members of the genus that are significant agricultural pests include *X. pyrrhoderus* (grape vines) and *X. quadripes* (mature coffee bushes).

Risk Factor	Rating	Narrative
Ecological Suitability	Moderate to High	The various tree-inhabiting species of this genus exist from Europe through Japan, and from Siberia to south to the Turkey and Iran.
Host Specificity	Variable	Low to High, depending on the species. Various members of the species attack hardwoods and/or conifers. Some species (e.g., *altaicus, quadripes*) can attack apparently healthy trees.
Survey Methodology	Moderate	Species of *Xylotrechus* may have pheromones that could potentially be used to bait traps. *Xylotrechus hircus* has been trapped in funnel traps baited with a 4-lure combination of ultra high release ethanol, ultra high release alpha-pinene, Ips lure, and triple lure. Apparently, the majority of other work has identified pheromones for only two species, neither of which would be expected in SWPM (*quadripes* and *pyrrhoderus*).
Taxonomic Recognition	Moderate	
Destination of Imported Material	High	
Potential Economic Impact	Variable	Medium to high, with a high degree of uncertainty
Entry Potential	Variable	Medium to high, depending on the species (note that *X. hircus* is one that would be expected to have a relatively low risk of entry). Various species are broadly distributed, relatively common, and infest wood that is used for SWPM.

Establishment Potential	Moderate to High	Capture in of specimens in traps in Oregon suggests the possibility of an incipient population there (surveys apparently have been planned).
Life Cycle		
Websites of Interest:	http://www.cedarcreek.umn.edu/insects/album/024106123ap.html http://www.cedarcreek.umn.edu/insects/024106n.html http://spfnic.fs.fed.us/exfor	

ATTACHMENT 8

LIST OF IMPORTERS OF WOODBORER/BARK BEETLE HOST MATERIAL

To be released shortly

ATTACHMENT 9

LIST OF DESTINATIONS FOR SHIPMENTS ISSUED (PPQ 523) FOR SOLID WOOD PACKING MATERIAL IN 2002

LANDFILL SITES THAT RECEIVE DUNNAGE AND SWPM FROM NEW YORK CITY

For time period: 07/01/02-01/31/03				
State	Disposal site	Tonnage	Percentage	Avg. Per day
CT	Bridgeport Resco	0	0	0
NJ	American Refuse, Essex Co.	3000,010.54	13.3	1695.97
NJ	Warren County	11886.16	0.5	67.15
NY	American Refuse, Hempstead	16913.17	0.8	95.55
NY	High Acre	0	0	0
NY	Westchester Resco, Peekskill	6423.26	0.3	36.29
OH	American Waste Disposal	4677.41	0.2	26.43
OH	Carbon/Limestone, Poland	37714.81	1.7	213.08
OH	Harrison County (Pending)	0	0	0
PA	Alliance Sanitary (Empire)	139171.77	6.2	786.28
PA	American Refuel (Chester/Del/DCRRF)	125412.18	5.6	708.54
PA	Bethlehem Landfill	49684.82	2.2	280.71
PA	Blue Ridge Landfill	142404.02	6.3	804.54
PA	Commonwealth Environmental System	9300.34	0.4	52.54
PA	Cumberland County Landfill	41394.27	1.8	233.87
PA	Grand Central Sanitary	42597.22	1.9	240.66
PA	Greenridge Reclamation	25445.57	1.1	143.76
PA	Greentree Landfill	235057.63	10.5	1328.01
PA	Imperial Landfill	7837.22	0.3	44.28
PA	Keystone Landfill	68951.73	3.1	389.56
PA	Lakeview Landfill	0	0	0
PA	Laurel Highland	246829.82	11.0	1394.52
PA	Modern Landfill	78294.64	3.5	442.34
PA	Mostoller Landfill	56733.78	2.5	320.53
PA	Pine Grove	18544.28	0.8	104.77
PA	RCC/Shade Landfill	130144.82	5.8	735.28
PA	South Hills Landfill	0	0	0
PA	Southern Alleghenie	1893.25	0.1	10.70
PA	Valley Landfill	0	0	0

PA	Wheelabrador Falls	0	0	0
PA	York County	0	0	0
SC	Lee County	0	0	0
VA	Amelia/Maplewood	0	0	0
VA	Atlantic Waste Disposal	333568.63	14.8	1884.57
VA	Brunswick, Lawrenceville	20139.32	0.9	113.78
VA	Brunswick County Landfill	0	0	0
VA	Chambers/Charles City	53335.73	2.4	301.33
VA	King and Queen Landfill	41040.78	1.8	231.87
VA	King George County	0	0	0
VA	Maplewood Recycling	0	0	0
VA	Middle Peninsula	0	0	0

PRIVATE VENDOR TRANSFER STATIONS UNDER CONTRACT TO THE DEPARTMENT OF SANITATION, NEW YORK

Updated: June 4, 2003

State	Facility	Address	Contract Tons
NY	Harlem River Yard	98 Lincoln Avenue Bronx	1400
NY	Waste Services	920 E 132 Street Brooklyn	600
NY	Waste Management	215 Varick Street Brooklyn	1400
NY	IESI of NY	577 Court Street Brooklyn	1100
NY	IESI of NY	110 50th Street Brooklyn	950
NY	Waste Management	38-50 Review Street Queens	900
NY	Tully Environmental	127-30 34th Avenue Corona	900
NY	American Refuel	600 Merchant Concourse Hempstead, LI	150
NJ	Waste Management	666 Front Street Elizabeth	625

NJ	Waste Management	864 Julia Street Elizabeth	635
NJ	SWTR	442 Frelinghuysen Avenue Newark	1225
NJ	ACS Services	30-35 Fulton Street Patterson	1000
NJ	Eastern Waste	264 Broadway Jersey City	350
NJ	ACS Services	301 Maltese Drive Totowa	480
NJ	American Ref-Fuel	183 Raymond Boulevard Newark	1700

WASTE STREAM OF LONG ISLAND

Updated 6/4/03

The following facilities and/or locations receive waste material from Long Island.

New Jersey

Care Environmental Corporation, Landing NJ
Passaic Valley STP

New York

Albany Landfill, Albany NY
Mohawk Valley Organics, Montgomery NY

Ohio

A&L Salvage, Lisbon OH
Carbon Limestone Landfill, Mahoning County
CLD, Salem OH
Imperial Landfill
Minerva Enterprises
Poland
WMI American Landfill, Waynesbury OH

Pennsylvania

BFI of PA Imperial Landfill, Imperial PA
Chester
Clinton County
Conestoga Landfill

King and Queen Landfill
Leeper Landfill
Superior Greentree Landfill, Elk Fox Township
Tully Town

Virginia

Brunswick County Landfill
King and Queen Sanitation Landfill, King and Queen County
WM USA Waste of Virginia, Inc., Charles City VA

GUIDELINES FOR PLACING BLACK LIGHT TRAPS FOR THE NATIONAL EXOTIC WOOD BORER/BARK BEETLE SURVEY

Updated: June 4, 2003

MATERIALS

- Black light trap, battery and support
- Light bulb in trap and one replacement bulb
- Fuses in trap and two replacements
- Sifting screens
- Kill strip in trap and one replacement
- Extension cord(s)

DESCRIPTION

Figure 14. Black light trap. Illustration: Gemplers

The attractant is a 22-watt black light tube mounted on clear acrylic vanes. The collection container is a 5-gallon polypropylene bucket with an aluminum funnel that fits the lip of the bucket. Traps come equipped with ballast, photo switch, aluminum lid, and attaching cords. Some are equipped with a power cord with alligator clips for 12-volt DC operation, or the light setup may be purchased to operate on 110/115 V AC household type current.

Attracted insects are stunned when they strike the acrylic vanes. They fall through the funnel, and drop into a collection container. This container includes another small funnel and two screens that sift the insects by size and minimize specimen damage.

ASSEMBLY

1. Assemble the trap according to manufacturer's instructions.

2. Hang a kill strip on the inside of the collection container. Be sure to avoid direct contact with the chemical and avoid breathing the vapors.

3. Replace the strip every 2 months or sooner if insects are not dead in a reasonable time. An additional kill strip in the trap may increase effectiveness. Always handle kill strips with gloves or with the foil pouch in which it is delivered.

4. Place the small screen (1/4 inch mesh) in the bottom part of the collection container, allowing at least an inch between the screen and the bottom for the smallest insects to fall. Place the large screen (1/2 inch mesh) above the bottom screen, separated by at least an inch to allow sifting out of larger insects.

5. Secure the collection container to the black light trap.

GENERAL TRAP PLACEMENT CONSIDERATIONS

Outdoor Placement

1. Most insects are attracted to black light traps that are no more than 200 feet away. The best results occur when traps are placed with a 180 degree arch of visibility within 200 feet of a host.

2. Place the trap in an area with minimal interference from other light sources. If at all possible, place it 500 feet away from other light sources.

3. When possible, place near a light reflective surface to increase its visibility.

4. Place close to the potential host trees adjacent to areas where foreign host materials have been stored or handled.

5. Try to place the trap in an unobscured area. Be aware of screening it with vegetation or structures. For example, placing the trap in the center of a clump of trees or in an area that is closely surrounded by buildings may drastically reduce its effective range.

6. Place the trap some distance from the edge of a clump of trees and raise the light off the ground to at least eye level for increased effectiveness. An example of a good location is a flat roof top of a poorly lighted warehouse.

Indoor Placement

1. Place one black light trap per building.

2. Black lights attract most insects from no more than 200 feet. The best results occur when traps are placed where there is a 180 degree arch of visibility.

3. Place in an area where there is minimal interference from other light sources. When possible have the warehouse lights turned off at night.

4. The black light trap should be placed at least at eye level height. If possible, place the black light trap on the flat roof of an indoor office, restroom, or similar structure.

5. When possible, place near a light reflective surface to increase the visibility of the light.

6. Don't block the trap's range by screening it with interfering structures or other materials. Locate the trap so that it does not interfere with the facility's daily operations.

SERVICE

1. Service the trap at least weekly.

2. Battery operated traps may require daily servicing to keep the battery charged.

3. Replace the collection container by unhooking the attaching.

4. Routinely check for leaves, insects, and other debris in the rain catch pan. If the drains in the catch pan become blocked, water can flood the collection container.

5. Empty the collection container using the following steps:

- Remove the funnel
- Remove the top screen, then the bottom screen
- Remove any remaining insects and debris from the bottom of the container.
- Put back the insecticidal strip that may fall out of the container.

If you are unable to empty the collection container and search for suspect specimens at the trap site, you can replace the collection container. If you remove a collection container from the trap site, be sure to label the specimen container with site, time and date information.

MAINTENANCE

Use the following troubleshooting checklist when a black light trap stops operating with no obvious physical damage or reason.

1. Check the power cord connection on the trap and make sure it is connected and tight.

2. Check that the two power connections of the bulb are secure.
3. Ensure that the power source end of the power cord is connected properly to the battery.
4. Check that the trap fuse beneath the electrical box is intact.
5. Check that the bulb is not burnt out.
6. Replace the starter in the electrical box.
7. Some traps have reset buttons. If there is a power loss, press this button to restart the light
8. If the trap still doesn't operate, replace with a functional black light trap.

GUIDELINES FOR PLACING LINDGREN® FUNNEL TRAPS FOR THE NATIONAL EXOTIC WOOD BORER/BARK BEETLE SURVEY

Trapping procedures updated, June 4, 2003

Supplies

Figure 15. Lindgren 12-funnel trap. Photo: Phero-Tech

Trap Placement:

- 12- funnel Lindgren trap with "wet" style collecting cup
- Lures: UHR alpha-pinene (blue pouch), UHR ethanol (black pouch), 3-component exotic *Ips* EBB lures (2 bubble caps, 1 pouch).
- Sealable plastic container with tight-fitting lids to store and transport lures (one container per lure type).
- lure holders (nylon cable ties or lure holders provided)
- disposable latex gloves
- hammer (for pounding in rebar)
- 2-3' length of rebar (for pilot hole for trap hanger)
- small twine, rope or twist ties to secure trap to hanger
- gallon jug of preservative (see below)
- trap tags
- trap cards or data sheets
- water or other hand cleaner for washing up
- paper towels

A. Trap Checking - Tote box with the following supplies:

- paint filter for straining trap contents
- wide mouth container to strain fluid into (e.g., quart-size cottage cheese or yogurt container)
- small empty can (e.g. tuna fish can) to place collecting cup on to avoid tipping over
- quart and gallon size "locking zipper" type plastic freezer bags
- Plastic squeeze bottle with 70-75% alcohol
- small paint brush for manipulating small specimens
- forceps
- empty gallon container (e.g. milk jugs) for used antifreeze
- wire cutters
- small funnel
- lubricant (bar soap or wax for collecting cup rims)

- adhesive labels for specimen cups
- permanent marker
- water or other hand cleaner for washing up
- paper towels

B. Sample Submission and Processing:

- 70-75% ethanol
- forceps
- sample data labels and data sheets
- indelible ink pens
- "locking zipper" type plastic bags
- mailing tubes or boxes

C. Bulk/Extra Supplies:

- Traps, trap hangers, lures
- 70-75% ethanol
- preservative: 50:50 water to propylene glycol (Sierra brand or other lower toxicity propylene glycol based antifreeze) with a few of drops of liquid detergent added to break up surface tension
- disposable latex gloves
- "locking zipper" type plastic bags
- labels and data sheets
- mailing tubes or boxes

1. Number and Types of Traps

Three 12-funnel Lindgren traps will be placed at each site. Each trap will be baited with one of the three lures or lure combinations used in 2001 and 2002. Lindgren funnel traps and lures are available from PheroTech, Inc. Delta, BC, 1-800-665-0076.

- Ultra-high release (UHR) ethanol lure (black pouch) only (general attractants for woodboring insects in deciduous hosts).

- UHR alpha-pinene (blue pouch) and UHR ethanol (black pouch) lures together (general attractants for woodboring insects in coniferous hosts).

- Three-component exotic bark beetle lure (2 bubble caps, one pouch). More specific for conifer-feeding exotic bark beetles e.g. *Ips typographus, Ips sexdentatus, Hylurgus ligniperda* and *Orthotomicus erosus*.

2. Trapping Period

The trapping period will be throughout the approximate adult activity period from mid-March through mid-October, depending on local climate. Traps should be placed in the field as soon as adult activity periods begins, and remain through approximately mid-October or later. Actual trapping periods could vary by location.

3. Trap Placement and Setup

Lindgren funnel traps attract target species by lures (olfactory attraction) and by imitating tree boles (visual attraction). Traps should be placed in the most suitable and secure situation possible, given the constraints listed below. Some of the following trap placement criteria at a given site listed below may not be met. The criteria below are listed in approximate order of importance.

- Place traps within 100m of potential host trees. Trap effectiveness rapidly declines at greater distances.

- Set traps at least 25m apart when possible. Traps should not be set closer than 10m apart to avoid possible trap interaction.

- Place traps out of direct sunlight, preferably in partial shade, or complete shade if the trap remains visible from a distance. Direct sunlight reduces lure lifespan and may make traps less attractive to target species. A good place to hang traps is at the margin of a stand of host trees.

- Place traps with EBB lures 25-50m from possible host conifer trees. Insects attracted to the traps could infest these trees.

- Avoid placing traps near obviously injured or fallen potential hosts, which could compete for target species. Tree volatiles may interfere with trap effectiveness.

- Place traps upwind (based upon prevailing winds) of potential sources of target species.

- Place traps so they are visible by line-of-sight from potential sources of target species (e.g. piles of SWPM, possible host trees etc.). Make sure that traps are not obscured by vegetation. If appropriate, clip or remove any such vegetation. This is especially true of vegetation likely to

grow rapidly between trap visits, such as blackberries. Remember, target species are attracted to visual aspects of Lindgren funnel traps as well as olfactory characteristics.

Traps can be set up using one of the following methods. Trap stands provide the most flexibility in terms of ease of set-up and trap placement and are the preferred method. In all cases, traps should be hung so that the collecting container is at least 12" above the ground and any ground cover or other vegetation.

- Trap stands: Trap stands can be made from a nine foot length of 1/2" to 5/8" concrete reinforcing bar (rebar) with a one foot right angle bend at the top. If the ground is soft, the bottom of the stand may be pushed or twisted into the ground by hand. If not, a hammer and 2-3' piece of rebar can be used to make a pilot hole. The stand should be inserted as perpendicular to the ground as possible and deep enough to support the trap. Suspend the trap by wrapping the wire around the right angle bend at the top so the trap hangs freely. Tie the bottom funnel of the trap to the stand using a piece of twine, wire or twist tie to stabilize the trap and prevent it from swinging in the wind. Trap stands are the most versatile placement method because traps can be placed almost anywhere there is exposed ground. Other methods require other means of support which may limit trap site selection or may not be available at some sites.

- Suspended from a rope: Traps can be hung from a rope tied between two trees or other objects. The rope must be tight enough to support weight of trap without sagging.

- Hung from a branch or other object: Traps can be hung from a lower branch or other object such as a chain link fence.

Attach lures using nylon cable ties or the hangers provided. Use disposable latex gloves when handling lures and change them between lure types to prevent cross-contamination. Attach *Ips* (EBB) lures to the outside of the supports linking the funnels. Attach the top of UHR ethanol and alpha-pinene lures to the connecting supports so that the lure hangs outside of the trap with the bottom of the lure tucked into a lower funnel to provide support. The pouches should not block the hole in the bottom of the funnel.

Ensure that the rubber stopper is secure inside the bottom of the collecting cup with the large end of the stopper on the inside of the cup to prevent it from falling out.

Fill the collecting cup approximately 1/3 to 1/2 full with preservative BEFORE attaching it to the trap.

NOTE: BE SURE THAT ALL THE FLANGES ON THE BOTTOM FUNNEL AND COLLECTING CUP ENGAGE PROPERLY. THIS IS OFTEN NOT EASY TO DO.

Some collecting cups may originally fit tightly and require a certain amount of pressure when first attaching and twisting to secure to the trap. A lubricant (wax, bar soap etc.) can be applied to the cup lip if necessary before attaching it.

Record the trap site data on the trap card (see Attachment 4). At a bare minimum, this should include the name and physical address or location, legal or GPS locality data, date the traps are placed, and a simple map of the property upon which the traps are placed and the approximate locations of the traps on that property. One trap card map with appropriate notations of all three traps generally suffices.

4. Trap Checking

- Check traps every two weeks.

- Examine trap and make sure it is undamaged. If damaged, disturbed or if the site has become unsuitable, consider moving the trap to a better location and document the move on the trap card.

- Remove any debris blocking funnels, including leaves, twigs, spider webs etc.

- Ensure that all lures are still in place and still have fluid in them. The fluid levels in the transparent bubble caps are visible. Vapor pressure may make empty UHR ethanol and UHR alpha-pinene pouches appear full. These UHR lures are particularly prone to leaking.

- Remove the cup from the bottom of the trap and examine its contents. Remove all debris from the collecting cup with a pair of long forceps (leaves, twigs etc.). Before discarding this material, flush it with water in a paint filter to collect any entangled specimens. Strain contents through this filter into a wide mouth container (e.g., a quart-size yogurt or cottage cheese container). Check thoroughly for insects. Specimens are easily entangled or hidden in debris and some target species are very small.

- Rinse filter contents with a small amount of alcohol to rinse off antifreeze. Again, remove any large debris, rinsing it off into the filter first to ensure no insects are adhering to it.

- Place the filter and its insect contents into a quart-size "locking zipper" plastic freezer bag.

- Saturate the sample with ethanol, but don't have a lot of free ethanol floating around inside the bag.

- Place one or two paper towels in the bag and saturate them with ethanol, again limiting the free ethanol in the bag.

- Complete and place one of the paper labels in the bag. The label should contain the following information:

    - Date sample was collected.
    - City where sample was collected.
    - Type of site (urban forest, SWPM importer or recycler).
    - Lure type (i.e., Ips EBB, UHR a-pinene/ethanol, UHR ethanol).
    - Collector's name.

- Removing all the air inside possible, zip the bag shut.

- Complete and place an adhesive sample label on the outside of the bag.

- Place the bag inside a one-gallon "locking zipper" plastic freezer bag.

- Place the rest of the sample bags for a sample period in the gallon bag, following the preceding directions. When all the samples for a period are in the gallon bag, remove the air, and zip it shut.

- Place that bag inside another gallon bag, remove the air, and zip it shut.

- Place the packet of "locking zipper" bags inside an inexpensive small, flat, rectangular (dimensions of around 6-8 inches long, 4-5 inches wide, and 2-3 inches high) plastic opaque container that would be airtight (the type that have a ridge running along the top edge of the bottom part, with a lid with a groove into which that ridge fits). These procedures should make for a leak-proof container that could be placed in a small box for shipping to the taxonomist. Send the package via overnight mail or Federal Express to the person(s) designated by the SPHD to sort trap contents.

- If the preservative is too dilute, discard into a used preservative container. **DO NOT** discard used preservative onto the ground, street, etc. Used antifreeze should be disposed of according to local state and federal regulations.

- Pour preservative back into the collection cup and top up to 1/3 or 1/2 full with fresh preservative if necessary.

- Record on the trap card (see Attachment 4) the date the traps were set, checked or serviced, and removed. Record on the provided data sheet whether a trap yielded specimens. Use an indelible ink pen to complete the data sheet.

5. Lures and Lure Change Dates

- Store lures in a freezer until used.

- Transport and store lures separately in a large sealable plastic container to prevent breakage and contain leaks.

- UHR alpha-pinene and ethanol lures have a field-life of approximately 90days at 70-75° F. However, depending on local temperatures, some lures could deplete sooner. Both lures should be changed after 12 weeks, or as needed, as the lures become depleted. Therefore, if traps are placed by mid-March, lures should be changed approximately around the end of May and again in mid-August.

- Exotic *Ips* EBB lures have a field-life of approximately 60 days at 70-75° F. Lures should be changed approximately every 8 weeks, or as lures become depleted.

- Because the lures may become depleted more rapidly at higher temperatures, the amount of attractant remaining in the lures should be monitored biweekly when the traps are checked. If it looks like the attractant is becoming depleted the lure, the lure should be replaced.

- The change date for each lure should be recorded on the trap card. This will provide information on the longevity of the attractants.

ATTACHMENT 13

Contacts for Rapid Detection of Scolytidae Pilot Test

Name	Organization	Address	Phone	Email
National Contacts				
Mary Ellen Dix	USFS, S&PF FHP	Washington DC	202-205-1210	mdix@fs.fed.us
Coanne O'Hern	USDA APHIS	Riverdale, MD	301-734-8717	Coanne.E.O'hern@aphis.usda.gov
Sheila Andrus	USFS Research VMPRA	Washington DC	202-205-1561	sandrus@fs.fed.us
Joe Cavey	USDA APHIS	Riverdale, MD	301-734-8547	Joseph.F.Cavey@aphis.usda.gov
Paul Dunn	USFS Research VMPRA	Washington DC	202-205-1561	pdunn@fs.fed.us
Tom Hofacker	USFS, S&PF, FHP	Washington, DC	202-205-1106	thofacker@fs.fed.us
Jonathan Jones	USDA APHIS	Riverdale, MD	301-734-8247	Jonathan.M.Jones@aphis.usda.gov
David Lance	USDA APHIS	Otis, MA	508-563-9303	David.R.Lance@aphis.usda.gov
Steve Lingafelter	USDA Systematic Entomology Lab.	Washington, DC	202-382-1793	slingfe@sel.barc.usda.gov
Vic Mastro	USDA APHIS	Otis, MA	508-563-9303 ext 212	Vic. Mastro@aphis.usda.gov

Paul Schaefer	ARS, BIIR,	Newark, DE	202-205-1561	pschaefer@biir.ars.usda.gov
Southern Area Representatives				
Don Duerr	FS Forest Health Protection	Asheville, NC	829-259-0526	dduerr@fs.fed.us
Philip D. Bell	APHIS	Raleigh, NC	819-716-5590	Phillip.D.Bell@aphis.usda.gov
Robert Rabaglia	Maryland Dept of Agriculture	Annapolis, MD	410-841-5922	RabaglRJ@mda.state.md.us
Brian Sullivan	FS Southern Research Station	Pineville. LA		bsullivan@fs.fed.us
Northeastern Area Representatives				
Robert Acciavatti	FS Forest Health Protection	Morgantown, WV	304-285-1547	racciavatti@fs.fed.us
Bob Haack	FS Northcentral Research Station	East Lansing, MI	517-355-7740, ext 36	rhaack@fs.fed.us
E. Richard Hoebeke	Cornell University	Ithaca, NY	607-255-6530	Erh2@cornell.edu
Mike McManus	FS Northeast Research Station	Hamden, CN	203-230-4320	mlmcmanus@fs.fed.us
Noel Schneeberger	FS Forest Health Protection	Newtown Square, PA	610-557-4121	nschneeberger@fs.fed.us
Kathleen Shields	FS Northeast Research Station	Hamden, CN	203-230-4320	kshields@fs.fed.us

Western Area Representatives				
Dave Bridgwater	FS, Pacific Northwest Region	Portland, OR	503-808-2666	dbridgewater@fs.fed.us
Kathleen Johnson	Oregon Dept. of Agriculture	Salem, OR	503-986-4662	kjohnson@oda.state.or.us
Jim LaBonte	Oregon Dept. of Agriculture	Salem, OR	503-986-4749	jlabonte@oda.state.or.us
Alan Mudge	Oregon Dept. of Agriculture	Salem, OR	503-986-4665	amudge@oda.state.or.us
Iral Ragenovich	FS, Pacific Northwest Region	Portland, OR	503-808-2915	iragenovich@fs.fed.us
Roger Sandquist	FS, Pacific Northwest Region	Portland, OR	503-808-2975	rsandquist@fs.fed.us

ATTACHMENT 14

WOODBORER BARK BEETLE SURVEY METHODS SUPPLIERS

Supplier	Phone	Fax	Supplies
PheroTech, Inc. Attn: Bruce Thomson 7572 Progress Way Delta, British Columbia CN V4G 1E9	800-665-0076	604-940-9433	Lindgren Funnel Traps alpha-pinene lure IPS *lure (I.* typographus) IPS lure holders Ethanol lure, UHR
El Tech Technology Attn: David Stein 7 Woodland Avenue Larchmont, NY 10534	914-834-8865	914-834-8903	Chaloprax lure Pheroprax lure Theyson bark beetle traps (pine shoot beetle traps)
Hercon Environmental Company Attn: Priscilla MacLean Aberdeen Road Emigsville, PA 17318	717-764-1191	717-764-5211	pheromone lures, various
Bioquip	310-667-8800	310-667-8808	Universal black light
Gempler's	1-800-874-4755		Ellisco-type black light

ATTACHMENT 15

Information and Paperwork Distribution Checklist

Survey Results

	What information is transmitted	**From** whom	**To** whom	**When**
	Positive trap data	SPHD Designated	NAPIS	Continually
	Negative trap data	SPHD Designated	NAPIS	End of season
	Trap Card (Attachment 4)	Survey personnel	SPHD	When card is completed
	Trap Card (Attachment 4)	SPHD	USFS RapDet*	End of season
	• Interview Forms (Attachment 2) • ALB Survey Forms (Attachment 3)	SPHD Designated	SPHD	Weekly or at regular intervals
	• Interview Forms • Survey Forms • Summaries	SPHD	PPQ Regional Office	End of season
	Trap Data Summaries	SPHD	PPQ Regional Office	End of season
	Interview Form, Survey Form and Trap Data Summary Report	PPQ Regional Office	• CAPS National Survey Coordinator* • USFS RapDet Coordinator*	End of Season

**Please consult Attachment 13 for contact information.*

New Detections

	What information is transmitted	**From** whom	**To** whom	**When**
	• Detection of suspected new exotic • Specimen, properly preserved (see Attachment 11 or 12)	Survey personnel	Local Identifier	Immediately
	Preliminary ID	Local Identifier	USDA-recognized taxonomist	When specimen is preliminarily determined to be suspect
	Confirmed ID	USDA-recognized taxonomist	Local Identifier	ID is confirmed
	New Pest Detection	Local Identifier	• SPRO • SPHD	Immediately after ID is confirmed
	New Pest Detection	Local Identifier	NAPIS	Within 48 hours after SPHD/SPRO notification
	New Pest Detection	Local Identifier	• CAPS National Survey* Coordinator • FS RapDet Coordinator* • PPQ Emergency Programs* • PPQ Taxonomic Group*	Within 48 hours after confirmation
	New Pest Detection	PPQ SPHD	PPQ Regional Office	Immediately after confirmation

**Please consult Attachment 13 for contact information.*

Selected References

Amman GD, Cole WE, 1983. Mountain pine beetle dynamics in lodgepole pine forests. Part II: Population dynamics. General Technical Report, Intermountain Forest and Range Experiment Station, USDA Forest Service, No. INT-145, v + 59 pp.; 2 col. pl.; 5 pp.

Anderson WC, Guldin RW, Vasievich JM, 1987. Assessing risk to plantation investments from insect attacks. Research-Paper -Southern-Forest-Experiment-Station,-USDA-Forest-Service. 1987, No. SO-231, 6 pp.

Arguedas Gamboa M, Scorza Reggio F, 1991. Observations on the biology of Scolytodes alni Wood (Coleoptera: Scolytidae) alder (Alnus acuminata) bark beetle. Manejo-Integrado-de-Plagas. 1991, No. 20-21, 23-25.

Barclay HJ, Safranyik L, Linton D, 1998. Trapping mountain pine beetles Dendroctonus ponderosae (Coleoptera: Scolytidae) using pheromone-baited traps: effects of trapping distance. Journal-of-the-Entomological-Society-of-British-Columbia. 1998, 95: 25-31.

Belanger RP, Hedden RL, Lennartz MR, 1988. Potential impact of the southern pine beetle on red-cockaded woodpecker colonies in the Georgia Piedmont. Southern-Journal-of-Applied-Forestry. 1988, 12: 3, 194-199.

Berisford CW, Brady UE, Fatzinger CW, Ebel BH, 1986. Evaluation of a repellent for prevention of attacks by three species of southern pine bark beetles (Coleoptera: Scolytidae). Journal-of-Entomological-Science. 1986, 21: 4, 316-318.

Berisford CW, Dalusky MJ, Bush PB, Taylor JW Jr, Berisford YC, 1991. Efficacy, persistence, ground deposition, and human exposure of polymer-encapsulated lindane and chlorpyrifos used for control of the southern pine beetle. Phytoprotection. 1991, 72: 1, 15-20.

Berisford CW, Payne TL, Berisford YC, 1990. Geographical variation in response of southern pine beetle (Coleoptera: Scolytidae) to aggregating pheromones in laboratory bioassays. Environmental-Entomology. 1990, 19: 6, 1671-1674.

Berrios C, Menendez JM, Rodriguez M, 1987. Presence of Ips on new species of pines in the north of Matanzas province. Revista-Forestal-Baracoa. 1987, 17: 2, 113-115.

Berti Filho E, 1979. Coleoptera of forestry importance. 1. Scolytidae. [Coleopteros de importancia florestal: 1 - Scolytidae.] IPEF, recd. 1981, No. 19, 39-43.

Byers JA, Zhang QingHe, Schlyter F, Birgersson G, Zhang QH, 1998. Volatiles from nonhost birch trees inhibit pheromone response in spruce bark beetles. Naturwissenschaften. 1998, 85: 11, 557-561.

Cameron RS, DeBarr GL, 1989. Responses of Dioryctria clarioralis, D. disclusa and D. merkeli to pheromone baits in Georgia and Texas. Proceedings of the 3rd Cone and Seed Insects Working Party Conference, held in Victoria, British Columbia, Canada, on 26-30 June 1988. 1989, 174-180.

Cook SP, Hain FP, 1988. Toxicity of host monoterpenes to Dendroctonus frontalis and Ips calligraphus (Coleoptera: Scolytidae). Journal-of-Entomological-Science. 1988, 23: 3, 287-292.

Cook SP, Hain FP, 1992. The influence of self-marking with fluorescent powders on adult bark beetles (Coleoptera: Scolytidae). Journal-of-Entomological-Science. 1992, 27: 3, 269-279.

Cook SP, Hain FP, Nappen PB, 1990. Inability to rear bark beetles (Coleoptera: Scolytidae) on tissue-cultured host pine callus. Journal-of-Entomological-Science. 1990, 25: 1.

Craighead FC, 1950. Insect enemies of eastern [U.S.] forests. Misc. Publ. U.S. Dep. Agric. 1950. No. 657 pp. 679.

DeAngelis JD, Nebeker TE, Hodges JD, 1986. Influence of tree age and growth rate on the radial resin duct system in loblolly pine (Pinus taeda). Canadian-Journal-of-Botany. 1986, 64: 5, 1046-1049.

Dunn JP, Lorio PL Jr, 1992. Effects of bark girdling on carbohydrate supply and resistance of loblolly pine to southern pine beetle (Dendroctonus frontalis Zimm.) attack. Forest-Ecology-and-Management. 1992, 50: 3-4, 317-330.

Duelli P, Zahradnik P, Knizek M, Kalinova B, 1997. Migration in spruce bark beetles (Ips typographus L.) and the efficiency of pheromone traps. Journal-of-Applied-Entomology. 1997, 121: 6, 297-303.

Fee DJ, Putwain PD, Walmsley TJ, 1996. The establishment of naturalistic woodland plant communities on colliery spoil. Vegetation management in forestry, amenity and conservation areas: managing for multiple objectives, 19 and 20 March 1996, University of York, York, UK. Aspects-of-Applied-Biology. 1996, No. 44, 351-356.

Ferrell GT, 1978. Moisture stress threshold of susceptibility to fir engraver beetles in pole-size white firs. Forest Science, 24(1):85-92; 3 fig.

Ferrell GT, Smith RS Jr, 1976. Indicators of Fomes annosus root decay and bark beetle susceptibility in sapling White Fir. Forest Science, 22(3):365-369.

Fielding NJ, Evans HF, Williams JM, Evans B, 1991. Distribution and spread of the great European spruce bark beetle, Dendroctonus micans, in Britain - 1982 to 1989. Forestry Oxford, 64(4):345-358.

Flamm RO, Coulson RN, Beckley P, Pulley PE, Wagner TL, 1989. Maintenance of a phloem-inhabiting guild. Environmental-Entomology. 1989, 18: 3, 381-387.

Flamm RO, Pulley PE, Coulson RN, 1993. Colonization of disturbed trees by the southern pine bark beetle guild (Coleoptera: Scolytidae). Environmental-Entomology. 1993, 22: 1, 62-70.

Garraway E, 1986. The biology of Ips calligraphus and Ips grandicollis (Coleoptera: Scolytidae) in Jamaica. Canadian Entomologist, 118(2):113-121; 2 fig.

Grodzki W, 1998. Field trial on the use of pheromone traps in the monitoring of the double-spined bark beetle Ips duplicatus C.R. Sahlb. (Col.: Scolytidae) populations. Prace-Instytutu-Badawczego-Lesnictwa. 1998, No. 843-851, 95-109; Prace No. 846.

Groot P de, DeBarr GL, de Groot P, 1998. Factors affecting capture of the white pine cone beetle, Conophthorus coniperda (Schwarz) (Col., Scolytidae) in pheromone traps. Journal-of-Applied-Entomology. 1998, 122: 6, 281-286.

Groot P de, MacDonald LM, de Groot P, 1999. Green leaf volatiles inhibit response of red pine cone beetle Conophthorus resinosae (Coleoptera: Scolytidae) to a sex pheromone. Naturwissenschaften. 1999, 86: 2, 81-85.

Haack, R.A. 2002. Intercepted Bark and Wood-Boring Insects in the United States:1985-2000. Newsltr. Mich. Entom. Soc.. Sept.,V.47(3&4).

Jakus R, 1998. A method for the protection of spruce stands against Ips typographus by the use of barriers of pheromone traps in north-eastern Slovakia. Anzeiger-fur-Schadlingskunde,-Pflanzenschutz,-Umweltschutz. 1998, 71: 8, 152-158.

Kegley S, 1998. Using pheromone traps to protect pine stands from pine engraver (Ips pini (Say)) infestation. Forest-Health-Protection-Report -Northern-Region,-USDA-Forest-Service. 1998, No. 98-3, 3 pp.

Lakatos F, 1997. Applicability of pheromone baited traps in forest practice. Novenyvedelem. 1997, 33: 4, 165-172.

Lanier GN, Hendrichs JP, Flores JE, 1988. Biosystematics of the Dendroctonus frontalis (Coleoptera: Scolytidae) complex. Annals-of-the-Entomological-Society-of-America. 1988, 81: 3, 403-418.

Lanier GN, Teale SA, Pajares JA, 1991. Biosystematics of the genus Ips (Coleoptera: Scolytidae) in North America: review of the Ips calligraphus group. Canadian-Entomologist. 1991, 123: 5, 1103-1124.

Lemperiere G, Bailley D, 1986. Comments on the outbreaks of spruce bark beetle in Limousin. [Limousin: observation sur les manifestations du dendroctone de l'epicea.] Forets de France, No. 290, 18-22.

Lovelady CN, Pulley PE, Coulson RN, Flamm RO, 1991. Relation of lightning to herbivory by the southern pine bark beetle guild (Coleoptera: Scolytidae). Environmental-Entomology. 1991, 20: 5, 1279-1284.

Lyytikainen Saarenmaa P, Anderbrant O, Lofqvist J, Hedenstrom E, Hogberg HE, 1999. Monitoring European pine sawfly population densities with pheromone traps in young pine plantations. Forest-Ecology-and-Management. 1999, 124: 2-3, 113-121.

Macias Samano JE, Borden JH, Pierce HD Jr, Gries R, Gries G, 1997. Aggregation pheromone of Pityokteines elegans. Journal-of-Chemical-Ecology. 1997, 23: 5, 1333-1347.

McPheron LJ, Seybold SJ, Storer AJ, Wood DL, Ohtsuka T, Kubo I, 1997. Effects of enantiomeric blend of verbenone on response of Ips paraconfusus to naturally produced aggregation pheromone in the laboratory. Journal-of-Chemical-Ecology. 1997, 23: 12, 2825-2839.

Niu MD, Lu N, Zhao MG (ed), Shi JL (ed), Pan HY (ed), Wang YY, 1992. Brief report on the diffusion and damage and control of Tomicus piniperda L. Collection-of-achievements-on-the-technique-cooperation-project-of-P.-R.-China-and-F.-R.-Germany. 1992, 160-164.

Nord JC, Hastings FL, Jones AS, 1990. Field tests of pine oil as a repellent for southern pine bark beetles. Research-Note -Southeastern-Forest-Experiment-Station,-USDA-Forest-Service. 1990, No. SE-355, 8 pp.

Ohmart CP, 1982. Destructive insects of native and planted Pinus radiata in California, and their relevance to Australian forestry. Australian Forest Research, 12(2):151-161.

Paine TD, Stephen FM, 1987. Fungi associated with the southern pine beetle: avoidance of induced defense response in loblolly pine. Oecologia. 1987, 74: 3, 377-379.

Paine TD, Stephen FM, Cates RG, 1988. Phenology of an induced response in loblolly pine following inoculation of fungi associated with the southern pine beetle. Canadian-Journal-of-Forest-Research. 1988, 18: 12, 1556-1562.

Paine TD, Stephen FM, Cates RG, 1993. Within- and among-tree variation of the induced response of loblolly pine to a fungus associated with Dendroctonus frontalis Zimmermann (Coleoptera: Scolytidae) and sterile wounding. Canadian-Entomologist. 1993, 125: 1, 65-71.

Payne TL, Billings RF, 1989. Evaluation of (S)-verbenone applications for suppressing southern pine beetle (Coleoptera: Scolytidae) infestations. Journal-of-Economic-Entomology. 1989, 82: 6, 1702-1708.

Riley MA, Goyer RA, 1988. Seasonal abundance of beneficial insects and Ips spp. engraver beetles (Coleoptera: Scolytidae) in felled loblolly and slash pines in Louisiana. Journal-of-Entomological-Science. 1988, 23: 4, 357-365.

Ross DW, Daterman GE, 1997. Using pheromone-baited traps to control the amount and distribution of tree mortality during outbreaks of the Douglas-fir beetle. Forest-Science. 1997, 43: 1, 65-70.

Ross DW, Gibson KE, Thier RW, Munson AS, 1996. Optimal dose of an antiaggregation pheromone (3-methylcyclohex-2-en-1-one) for protecting live Douglas-fir from attack by Dendroctonus pseudotsugae (Coleoptera: Scolytidae). Journal-of-Economic-Entomology. 1996, 89: 5, 1204-1207.

Safranyik L, Shore TL, Linton DA, 1998. Effects of baiting lodgepole pines naturally attacked by the mountain pine beetle with Ips pini (Coleoptera: Scolytidae) pheromone on mountain pine beetle brood production. Journal-of-the-Entomological-Society-of-British-Columbia. 1998, 95: 95-97.

Savoie A, Borden JH, Pierce HD Jr, Gries R, Gries G, 1998. Aggregation pheromone of Pityogenes knechteli and semiochemical-based interactions with three other bark beetles. Journal-of-Chemical-Ecology. 1998, 24: 2, 321-337.

Scholz D, Tchabi A, Markham RH, Poehling HM, Borgemeister C, 1998. Factors affecting pheromone production and behavioral responses by Prostephanus truncatus (Coleoptera: Bostrichidae). Annals-of-the-Entomological-Society-of-America. 1998, 91: 6, 872-878.

Serez M, 1987. Use of the aggregation pheromone preparation 'Ipslure' against the Mediterranean pine bark-beetle Ips (Orthotomicus) erosus (Woll.) (Col., Scolytidae). [Verwendung des Aggregationspheromon-Praparats 'Ipslure' gegen den mediterranen Kiefernborkenkafer, Ips (Orthotomicus) erosus (Woll.) (Col., Scolytidae).] Anzeiger fur Schadlingskunde, Pflanzenschutz, Umweltschutz, 60(5):94-95.

Svestka M, Wiesner CJ, 1997. Development and use of pheromone dispenser in forest protection against Ips acuminatus. Zpravy-Lesnickeho-Vyzkumu. 1997, 42: 2, 23-25.

Targamadze KM, Shavliashvili IA, Mukhashavria AL, Murusidze BV, Zedginidze AA, 1975. Determining the economic effectiveness of forest pest (European spruce beetle) control expenditure. VIII International Plant Protection Congress, Moscow, 1975. Volume II. Papers at sessions I ... II ... III ... IV .., 23-27.

Taylor AD, Hayes JL, Roton L, Moser JC, 1992. A phloem sandwich allowing attack and colonization by bark beetles (Coleoptera: Scolytidae) and associates. Journal-of-Entomological-Science. 1992, 27: 4, 311-316.

Thistle H, Shea P, Holsten E, Quilici D, 1999. Pheromone dispersion in a canopy trunk space analysis of plume data. ASAE-CSAE-SCGR Annual International Meeting, Toronto, Ontario, Canada, 18-21 July, 1999. 1999, 14 pp.; ASAE Paper No. 991013.

Thistle HW, Shea P, Holsten E, Quilici D, 1998. Pheromone dispersion in the canopy trunk space. Brighton Crop Protection Conference: Pests & Diseases - 1998: Volume 2: Proceedings of an International Conference, Brighton, UK, 16-19 November 1998. 1998, 669-674.

Tillman JA, Holbrook GL, Dallara PL, Schal C, Wood DL, Blomquist GJ, Seybold SJ, 1998. Endocrine regulation of de novo aggregation pheromone biosynthesis in the pine engraver, Ips pini (Say) (Coleoptera: Scolytidae). Insect-Biochemistry-and-Molecular-Biology. 1998, 28: 9, 705-715.

United States. http://www.aphis.usda.gov/ppq/pra/swpm/complete.pdf

USDA APHIS PPQ 1998. Solid Wood Packing Material From China: Initial Pest risk Assessment on Certain Woodborer Beetles Known toBe Associated With Cargo Shipments: Asian Longhorned Beetle (*Anoplophora glabripennis*), *Ceresium*, *Monochamus* and *Hesperophanes.*

USDA APHIS PPQ 2000. Pest Risk Assessment for Importation of Solid Wood Packing Materials into the USDA APHIS PPQ 2001. Pest Risk Assessment on Certain Woodborer Beetles Known to Be Associated With Artificially Dwarfed Plants (ADP): Citrus Longhorned Beetle (CLB), (*Anoplophora chinensis*), The White Spotted Longhorned Beetle (WSLB), (*Anoplophora malasiaca*), and *Chlorophorus diadema*.

Vaupel O von, Zimmermann G, Von Vaupel O, 1996. Preliminary trials on the combination of pheromone traps with the entomopathogenic fungus Beauveria bassiana (Bals.) Vuill. against the bark beetle species Ips typographus L. (Col., Scolytidae). Anzeiger-fur-Schadlingskunde,-Pflanzenschutz,-Umweltschutz. 1996, 69: 8, 175-179.

Waters WE, Stark RW, Wood DL, Waters WE (ed), Stark RW (ed), Wood DL, 1985. The pine-bark beetle ecosystem: a pest management challenge. Integrated-pest-management-in-pine-bark-beetle-ecosystems. 1985, 1-48; 4 fig.

Zhao BoGuang, Jing ZhiGao, Wang KeShan, Li YaoSan, Song GongDe, Zhao BG, Jing ZG, Wang KS, Li YS, Song GD, 1996. Field tests of the feasibility of sex pheromone plus virus dispenser technique. Scientia-Silvae-Sinicae. 1996, 32: 4, 348-353.